

UNIVERSITY OF KWAZULU-NATAL

**THE IMPACT OF SUPPLIER QUALITY MANAGEMENT ON ESKOM'S
EASTERN REGION POWER NETWORK OPERATIONS**

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Abstract

South Africa's national power utility, Eskom, procures products and services from a multitude of suppliers for its operations. Annually, Eskom's Eastern Region spends approximately two billion rand on the procurement of products and services for its power network operations. Considering the expenditure, what is the effect of supplier quality management on Eskom's operations? The aim of this study was to determine the impact of supplier quality management on Eskom's Eastern Region's power network operations. A multi methods approach was used for this study which included quantitative data and phenomenological interviews.

For the past two financial years, Eskom's Eastern Region procured R2.7billion worth of products and services from 187 suppliers for its operations. A probability sample of 82 suppliers was drawn from this population. The sample was composed of 58% electrical construction companies, 20% product manufacturers, 17% consulting engineers and 5% electrical hardware distributors. Data was collected using an email questionnaire developed by the researcher. Structured phenomenological interviews on supplier quality management were conducted with 41 employees of Eskom's Field Services Department. These employees were chosen as they are directly accountable for managing network operations and are end-users of suppliers' products and services. Significantly, the statistical analysis and the outcome of the phenomenological interviews revealed points of convergence and divergence between the stated positions of the suppliers and the actual experience of Eskom's employees on quality of products and services.

By combining the quantitative and qualitative dimensions of this study, the analysis illustrated the existence of cavernous gaps between suppliers and actual experience of Eskom employees on quality management areas such as suppliers' commitment to product and service quality, focus on customer satisfaction, effective quality control and network operations. Several elements of the suppliers' quality management programmes don't meet Eskom's expectations. The results of the study can benefit both suppliers and Eskom in identifying aspects of quality management that are negatively impacting operations and recommends areas of improvement.

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Terms and Abbreviations

ASQ	American Society of Quality
CQI	Chartered Institute for Quality
ISO	International Standards Organisation
NERSA	National Energy Regulator of South Africa
SOE	State Owned Enterprise
TQM	Total Quality Management

CHAPTER 1

INTRODUCTION

1.1 Introduction

Eskom is a South African and trans-African electrical power utility which plays a critical role in enabling the growth and development of the South African (and African) economy. In terms of generation capacity, Eskom is the world's seventh largest power utility.

According to Eskom's web based company profile the company, "generates approximately 95% of the electricity used in South Africa and approximately 45% of the electricity used in Africa." On the basis of energy sales to various sectors of South Africa and Southern Africa, Eskom's customer profile reflects its diverse involvement in the entire spectrum of the economy as follows:

- residential – 4.7%;
- commerce and agriculture – 6.4%;
- industry – 25.5%;
- mining and rail – 15.8%;
- municipalities – 41.5%;
- foreign sales – 6.1%.

(Company Information ... 2011)

Eskom considers its role within the South African socio-economic landscape to be broader than merely the utilitarian provision of electricity for its customers. It encompasses what it terms as "growth and development aspirations" of South Africa and has stipulated its value-proposition to include:

- providing electricity to all South Africans;
- developing mutually beneficial arrangements with support industries such as the coal mining sector and related industries;
- driving transformation through its procurement strategy;
- creating jobs and new industries through local content initiatives associated with its mega capacity expansion programmes;

- improve environmental performance including climate change mitigation.

(Company Information ... 2011)

Eskom's power network operations are supported by a variety of product manufacturers and service delivery organisations. The particular research interest of this study was on supplier quality management related to procurement of products and services from local suppliers. The specific question, which this study addressed, was the consequences and effects of supplier quality management on Eskom's power network operations.

In its Company Profile information, Eskom states, "additional power stations and major power lines are being built on a massive scale to meet rising electricity demand in South Africa. Eskom's capacity expansion budget is R385 billion up to 2013 and is expected to grow to more than a trillion rand by 2026. Ultimately Eskom will double its capacity to 80 000MW by 2026." In addition to investment in generation capacity expansion, reference is also made to significant investment in new power transmission lines to deliver power to the growth centres of the country. (Build programme in ... 2011).

To deliver on its strategic commitments and effectively manage its operations, Eskom is reliant upon a vast array of suppliers of products and services. This capital expenditure has become critical to the growth of the South African economy and is designated to procure products and services for infrastructural expansion.

One of the corporate divisions of Eskom is its Distribution Division which is accountable for ensuring safe, reliable, efficient and optimal distribution of power to its customers. Eskom's Eastern Region is a major subsection of the Distribution Division tasked with distributing power to its customers in KwaZulu-Natal Province. Eskom's Eastern Region's annual budget for power network capital expansion and operation exceeds R3 billion rand. Most of this expenditure is committed to procurement of products and services from a multitude of suppliers. In view of the onerous legal, safety, health and operational compliance requirements, the question to be posed is: does Eskom have a systematic approach to ensuring

supplier quality management is effectively and efficiently managed to meet its safety, operating and statutory requirements? The researcher chose to conduct the research study in KwaZulu-Natal province as both he and most of the research participants are located in the region. The supplier database and research information were accessible from Eskom's archival resources situated at its Regional Head Office in New Germany. There was negligible research value to be gained from widening the scope to Eskom on a national basis. From a logistical perspective, it was imperative that the study was confined to the KwaZulu-Natal province. Other Regions of Eskom's Distribution Division in various provinces function operationally similar to Eskom's Eastern Region. This research study's results may be extrapolated to apply to all of Eskom's Regions nationally.

In this chapter, the motivation and focus for this research study is discussed, the problem statement is defined, the objectives and research questions of the study delineated, the research methodology outlined and the research limitations are stated.

1.2 Motivation for Research

The researcher is a Professional Engineering Technologist currently employed in Eskom's Eastern Region Engineering Department as the Technology and Quality Manager. His portfolio involves, among other deliverables, managing technology innovation, standards, specifications and implementation, monitoring performance of technology and technical quality management. Expanding on the technical quality management dimension of his output related to this study, the researcher's portfolio oversees:

- Development of quality assurance policies and procedures for implementation by the Quality Management team
- Manage supplier capability assessments
- Ensure supplier quality performance monitoring
- Manage product and supplier approval process
- Control supplier and product data

The researcher has a professional interest in the subject matter of the study.

In the past two financial years, 2009/10 and 2010/11, Eskom's Eastern Region has procured over R3 billion worth of goods and services from a multiplicity of suppliers for its core business network operations. High value procurement transactions are managed via contractual agreements between Eskom and its suppliers. The contractual requirements prescribe the commercial terms and expected performance criteria. Although contractual terms specify minimum expected performance criteria, they do not on their own prescribe the totality of supplier quality management requirements. The perceptions and practice of quality management by suppliers varies with each supplier as some suppliers are ISO (International Standards Organisation) accredited whilst others are not. This suggests quality management is applied by some suppliers through a structured, formalised and auditable approach whereas other suppliers have an informal or unknown approach. This study explored the quality management consequences of Eskom's contractual agreements concluded with its suppliers for its power network operations.

A systematic research study has not previously been conducted into supplier quality management impact on Eskom's network operation and therefore makes this research project a unique intervention. This study highlighted the criticality of developing and applying consistent quality management criteria across its supply chain operations. This study affords Eskom's regional management with a comprehensive understanding of how supplier quality management impacts upon fulfillment of its corporate mandate and its NERSA power distribution licence obligations which stipulate network performance criteria. The principal beneficiaries of this study are Eskom's suppliers and its field operations personnel who are required to operate the power network. This study also serves as a quality management effectiveness index to Eskom's management accountable for its supply chain operations in respect of procurement of products and services from suppliers. Lastly, the study provides valuable insights for the researcher in his portfolio as Eskom's Technology and Quality Manager to enhance quality management techniques in respect of supply of products and services.

1.3 Problem Statement

According to Lakhal, Pasin & Limam (2006) in their study of quality management impact on operations, it was found that there was a “positive relationship between quality management practices and organisational performance. Moreover, the findings show a significant relationship between management and infrastructure practices. In addition, the results illustrate a direct effect of infrastructure practices on operational performance and of core practices on product quality.”

For the large expenditure incurred by Eskom’s Eastern Region in the procurement of products and services, the key question that arises is: Does supplier quality management have a mediatory or contradictory impact on Eskom’s power network operations? The study conducted by Lakhal et al (2006) positive linked quality management systems to operational performance. In the context of this research project, the researcher studied the extension of this linkage beyond the domain of the supplier. Prior to this study, there was no clear understanding of how supplier quality management affected Eskom’s power network operation. The results of this study provided a clear indication of the translation of supplier quality management into operational performance domain of Eskom’s operations personnel.

Flynn, Schroeder & Sakakibara (1995) argued that suppliers of products who applied formal, structured and onerous quality control techniques to production of their core product resulted in achieving a competitive advantage and quality performance measures. The argument posited in this paper affirms the notion that those suppliers who invested resources in improving product quality had enhanced supplier relationships.

The International Organisation for Standardisation (ISO) is an international federation of national standards bodies whose task is to develop, maintain and establish standards for the effective functioning of organisations. With specific reference to quality management, ISO has established the 9000 Series of standards developed with the intention of aiding organisations “to implement and operate effective quality management systems”. Together they form a coherent set of quality management system standards facilitating mutual understanding in

national and international trade. (ISO 9000 essentials ...2000)

ISO has determined eight principles which form the essence of an effective quality management system. These being customer focus, leadership, involvement of people, process approach, system approach to management, continual improvement, factual approach to decision-making and mutually beneficial supplier relationships (ISO 9004 Quality Management Principles ... 2008).

Eskom, as an organisation, is not ISO accredited and compliant, although, some departments within the company have successfully applied for and have been accredited as ISO compliant. The quality management challenge facing Eskom is that it is a multibillion rand SoE with massive capital expansion plans and operational costs serviced by suppliers of products and services who may or may not be ISO accredited. In practical terms, this implies that there is a fundamental discordance in the perception of what constitutes minimum acceptable quality standards, both, from the perspective of Eskom and as well as its suppliers.

The variation in perceptions of quality management of products and services leads to ambiguous consequences for Eskom's core network operations business i.e. safe and efficient distribution of power in its licensed area – KwaZulu-Natal. The most important outcome for Eskom is that this nebulous quality management environment, in the long term, is a factor that impinges upon its ability to sustain its operations and fulfill its NERSA (National Energy Regulator of South Africa) licence mandate.

1.4 Research Questions

There are a number of questions, arising from this research project, addressed by this study. These questions posed are noted below:

- What is the percentage of Eskom's suppliers that are ISO accredited?
- Is it important for suppliers to have an officially documented quality management system policy?
- Are supplier's employees knowledgeable about the quality management objectives for products and/or services?

- Have suppliers fully optimised the cost of providing quality effort with costs of internal / external failure?
- Does Total Quality Management (TQM) system improve productivity and efficiency?
- What's the extent of supplier's experience of quality management problems within their organisations?
- Is Top Management of supplier organisations practically and visibly committed to meeting Eskom's technical quality requirements?
- Have suppliers implemented effective continual improvement strategies for products and services supplied to Eskom?
- Do suppliers have clearly defined quality management policies relevant to all products and/or services provided to Eskom?
- Are supplier's employees skilled, trained, competent and capable of meeting specified quality requirements?
- Do suppliers conduct consistent reviews on whether products and/or services are achieving quality objectives?
- Is customer satisfaction the main aim for supplier's operations?
- Is supplier's communication with Eskom about the quality of products or services supplied effective?
- Do suppliers have mechanisms established to obtain feedback and to determine whether Eskom's requirements are met as specified?
- Do suppliers have adequate quality control systems to prevent defective products and poor service rendered to Eskom?
- What is the effectiveness of supplier's timeous response to non-conformances and recurrence prevention strategies?
- What effect has supplier quality management systems had on performance, reliability, maintainability, safety and maintenance cost reduction of Eskom's power network operations?

1.5 Objectives

Quality management of a diverse range of goods and services associated with expenditure of this magnitude is a major logistical and supply chain challenge. By nature of the product, if provision of electricity is not managed, operated and distributed with due care, electricity can pose lethal risks for the public. It is for this reason that the generation, transmission and distribution of electricity is governed by onerous legislation, standards, specifications and operating procedures. By extension, suppliers of products and services to Eskom for infrastructure development, expansion and maintenance are required to uphold the highest standards of quality. It is imperative that Eskom ensures quality management criteria are applied throughout its supply chain process. Ambiguity and vagueness in quality management expectations from both Eskom and its service providers could result in dire consequences for Eskom's customers, increase in supply chain overhead costs, unserved energy costs and increased public safety risks due to power network maloperations.

The researcher investigated the effectiveness of products and services quality through Eskom's Eastern Region's supply chain process and the impact on its field operations. The fundamental aim of the study is to determine the impact of supplier quality management on Eskom's Eastern Region's power network operations. To achieve the research study aim, several objectives were identified.

The primary objectives of this study were to:

- Understand the supplier profile from the perspective of ISO accreditation and length of transaction history with Eskom;
- Explore the understanding of Total Quality Management (TQM) amongst suppliers;
- Determine suppliers practical commitment to quality management of products and services supplied to Eskom;
- Explore suppliers focus on and methods used to achieve customer satisfaction;
- Determine the effectiveness of quality control systems and methodologies applied by suppliers;

- Probe the effect of supplier quality management on achieving Eskom's Eastern Region's power network performance, maintainability, reliability and safety indices.

1.6 Overview of Dissertation Chapters

Chapter One: Introduction

The introductory chapter provides a background to the topic and locates the topic within context of the research question. The researcher's motivation for the study is discussed. The overall research aim and the specific objectives are listed. An overview of the chapters for this study is briefly discussed.

Chapter Two: Literature Review

This chapter is a review of relevant literature to the research question. This is structured according to the specific objectives laid down in Chapter One. The literature review traces the historical origins of quality management, provides an overview of the various definitions of quality, discusses the approaches to quality, analyses TQM in the operations environment, describes the manifestations of quality gaps, evaluates the cost of quality in relation to quality failures and methods of operational improvements. This chapter provides insight into some of the key concepts in Total Quality Management, reviews the linkages between Total Quality Management and operations management, identifies the areas of operations management impacted upon by quality management concepts, compares the theoretical and research positions of various authors on the implementation of Total Quality Management on operations management and critically appraises the conceptual framework advanced by experts in the field of quality management. Based on the review of available literature, the researcher develops a conceptual and contextual framework for the purposes of this study.

Chapter Three: Research Methodology

The methodology adopted for the research design is discussed in this chapter. The aim of the study is shaped and informed by the research method deployed. The research method involved used quantitative and qualitative data via administered questionnaires for Eskom's suppliers and structured interviews with

Eskom's network operations staff. The data recovered from the research instrument and the structured interviews formed the essence of the primary data needed for the study.

The research methodology was based on a multi-methods approach. The combination of quantitative and qualitative data contributed to a substantial understanding of a business research problem. Whilst a questionnaire may be useful for deriving quantitative data, the richness of research data is complemented by interviews to provide greater depth to the subject matter. Qualitative data compiled for this research project was the basis for the phenomenological dimension of the study.

Chapter Four: Presentation of Results

The presentation of data that was collected, compiled and consolidated for the study is detailed in this chapter. The multi-methods approach was based on data gathered from a questionnaire recovered from 82 Eskom suppliers and structured phenomenological interviews conducted with 41 Eskom employees involved with network operations. In total, the study involved 123 participants. Qualitative and quantitative data analysis was conducted first by consolidation of respondents information into Excel worksheets and thereafter exported to SPSS version 18 for statistical analysis. The outputs from SPSS are contained within tables and figures.

Chapter Five:

The discussion on the results from the multi-method research approach highlighted areas of convergence and divergence between suppliers and Eskom's employees on fundamental elements of this study. The responses of suppliers, which formed the essence of the quantitative data analysis and the structured interviews conducted with Eskom employees that was key to the phenomenological dimension, provides a composite understanding of the aim and objectives of the research study. The supplier responses are not discussed in a vacuum but contextualised within the lived experiences of Eskom's employees.

Chapter Six: Conclusions and Recommendations

The key focus of this chapter is the conclusions derived from the research project against the backdrop of the aim and objectives that were originally determined for the study. The areas of convergence and divergence between the aim of the research project and the findings determined from the study are reviewed. In the light of the conclusions derived, recommendations are made. In view of the problem statement defined, possible solutions are proffered for implementation. The limitations of the research project are also emphasised. The recommendations, for possible future studies related to this topic, are highlighted.

1.7 Limitations of the Study

The population that is the object of this study is comprised of suppliers who provide Eskom with high-end value products and services. These suppliers have a direct bearing on Eskom's Eastern Region's power network operations. The study was circumscribed by three principal parameters. Firstly, it was considered prudent to exclude suppliers and vendors whose products and services have a negligible influence on power network operations. These typically include vehicle suppliers, vegetation management companies, sundry item suppliers, office item suppliers and office maintenance contractors. Secondly, the sample included only suppliers who have recorded active transactions with Eskom over the past two financial years i.e. April 2009 to March 2011 and April 2010 to March 2011. Thirdly, the study established a threshold for those suppliers with a minimum value of R500 000 (five hundred thousand rand) and above. The study does not consider the influence of other factors on power network performance such as environmental, financial, human resource, technology used and the quality of maintenance. Each of these factors may have individual, collective or contributory consequences for power network operations.

The sample size has been limited to suppliers who provided products and services to Eskom's Eastern Region in excess of R500 000 over the past two years. Transactions with these suppliers account for approximately 70% of the total expenditure incurred by Eskom on procurement of goods and services for Eskom's power network operations. By using this filtered approach yielded a total of 187

suppliers as the study population. This was considered as an adequate representation of the target population. In addition, the sample excluded those suppliers whose products and services have little or no influence on its power network operations. The phenomenological dimension of the study was based on structured interviews with 41 of Eskom's network operation employees but excluded those employees who are employed within the supply chain arena.

The method of communication with the identified target audience was via email. Since suppliers are located throughout the KwaZulu-Natal Province with a few in other provinces, email was considered to be the most appropriate method of communicating the questionnaire. There are advantages to communication of the questionnaire in person but in this instance, it was not considered practicable.

1.8 Summary

Eskom is South Africa's largest state-owned electrical power producer and distributor. It plays a strategic role in the economy with a substantial forecasted capital expenditure. By 2013, Eskom's New Build Programme of investment in infrastructure and capacity expansion is expected to incur budgeted costs of R385 billion. Most of the projected expenditure is designated for the procurement of products and services from a diverse range of suppliers.

Eskom's Eastern Region is a subsection of its Distribution Division and is the subject of this study. In the past two financial years, Eskom's Eastern Region has spent over R3 billion in the procurement of products and services for its network operations. The focus of this study is to assess the impact of supplier quality management on the operation of its power network operations. Eskom's Eastern Region is required to comply with its NERSA licence mandate which stipulates minimum power network performance requirements. The quality of products and services procured by Eskom for its network operation influences Eskom's Eastern Region's ability to fulfill its NERSA licence obligations.

The researcher's interest in the study is motivated by his current managerial portfolio as the Regional Technology and Quality Manager, the degree to which

suppliers subscribe to the conceptual framework of quality management as defined by the ISO 9000 family of standards and developing an understanding of how supplier quality management impacts upon Eskom's power network operational performance.

Documented research studies have shown positive linkage between quality management systems applied and operational performance. In the case of Eskom's Eastern Region, the question arises about whether quality management has a mediatory or contradictory effect on its network operations. This study probed the impact of quality management practices by Eskom's suppliers on its power network operations. In Chapter 2, the literature relevant to the origins, development and consolidation of the conceptual framework of quality management is analysed and reviewed. The quality paradigm developed and applied in modern organisations is used as the basis for conducting the research study and gathering data.

CHAPTER 2

LITERATURE SURVEY

2.1 Introduction

At the outset, the term “quality” has a number of different interpretations depending on the context of its application. It is useful to articulate “quality” as a multidimensional concept to understand what it means and signify the variations in its application, to products and services (Hoyle 2010; Evans & Lindsay 2005). This literature review examines the influence of quality on operations management.

While a significant body of literature exists on the topic of quality management, this chapter focuses on:

- The historical origins of quality management within the operations environment;
- The different definitions and interpretations of quality as a concept;
- Multiple approaches to implementation of quality management;
- Total quality management in operations;
- Understanding quality gaps and how they occur;
- The derivation of the cost of quality;
- How organisations apply operational improvement strategies

(Schroeder, Goldstein & Rungtusanatham 2011; Hoyle 2010; Kruger, De Wit & Ramdass 2005)

In addition, this review examines the impact of the aforementioned concepts on how organisations conduct their operations. The concepts highlighted specifically relate to the field area of research.

2.2 Definition of Terms

According to Murray (2007), literature reviews for dissertations should commence with definition of key terms for two principal reasons viz. firstly, definitions determine how readers may interpret whatever is documented in the dissertation

and secondly, specialist terms may be used in varied ways. In the case of quality management, owing to the number of terms used in literature and the variations in the contextual meaning of these terms, the researcher considers it important to define some of the key terms.

Total Quality Management

Management of an entire organization so that it excels in all aspects of products and services that are important to the customer (Heizer & Render 2011).

Quality Management System

A set of interacting processes used by an organisation to achieve its quality objectives (Hoyle 2010).

Conformance Quality

Producing a product and / or delivering a service where the specifications are fully met (Schroeder et al 2011).

Quality at Source

A philosophy whereby defects are identified and corrected at the point where they occur thereby preventing them from being passed onto the end-user or customer (Krajewski, Ritzman & Malhotra 2010).

Quality Control

A process for maintaining standards of quality that prevents and corrects change in such standards so that the resultant output meets customer needs and expectations (Hoyle 2010).

Cost of Quality

Expenditure related to the achievement of product or service quality such as appraisal costs, preventions costs, internal failure and external failure costs as the expression of an organisation's quality related performance in financial terms. (Barnes 2008).

Continuous Improvement

The philosophy of continually seeking improvements in processes through the use of team efforts (Chase, Jacobs & Aquilano 2006).

Quality Gap

The difference between a customers' perceived expectation of a product or service and their actual experience with it (Pycraft, Singh, Phihlela, Slack, Chambers, Harland, Harrison & Johnston 2004).

Quality Assurance

A proactive approach to managing quality by seeking to prevent defects from appearing (Barnes 2008).

2.3 Origins of Quality in Operations

According to Barnes (2008), post-war Japan was in dire need of reconstruction and quality emerged as a central theme in its manufacturing sector. In the subsequent years, Japanese manufacturing companies came to be internationally recognised as leaders in the production of high quality products. Although the methodologies of the Japanese quality programmes were based on the teachings of the Americans, these ideas were unable to find traction on a similar basis within industry in the United States. The Japanese embraced American ideas and concepts by translating their philosophy of quality management into tangible product excellence. Japanese products were transformed from being perceived as products with questionable quality to products that bore the hallmark of the highest quality standards (Wilkinson, Redman, Snape & Marchington 1998).

Barnes (2008) stated that since the post-war years of the Japanese experience, the theoretical foundations and practical implementation of quality management philosophies has undergone a process of expansion and refinement. The implementation of quality management has grown from simply being quality control inspection interventions for product defect identification to Total Quality Management (TQM) where quality is placed at the core of the organisation's operations. In the evolution of quality concepts and philosophy, Dale & Cooper

(1992) identify four discernable phases viz. quality inspection, quality control, quality assurance and TQM. The four phases are not segmented but considered to be a continuum on the quality management development journey.

This section reviews the ideas of some of the pioneers of quality management especially the works of Feigenbaum, Crosby, Deming, Juran and Ishikawa. It's important to foreground the work of these individuals, often referred to as "quality gurus". These individuals have established the platform upon which the quality management edifice has developed in modern organisations. The literature survey expands upon key concepts emanating from the work of these "quality gurus".

2.3.1 Feigenbaum's Total Quality Control

Dr Armand Feigenbaum is considered to be one the pioneers of the concept of quality applied to industrial processes. His seminal work – Total Quality Control – first published in 1951 had a significant impact on industrial practices (Slack, Chambers & Johnston 2004).

According to Kruger et al (2005) Feigenbaum stated, "Total Quality Control is an effective system for integrating the quality development, the quality maintenance and the quality improvement efforts of various groups in an organisation so as to enable production and service at the most economical levels which allow for full customer satisfaction". Wilkinson et al (1998) stated that Feigenbaum believed achievement of quality objectives through inspection could not be realised as a function being performed on its own nor by sole intervention of the quality control departments. Instead, he advocated the Total Quality Control theory which makes cross-functional working an imperative for success.

Kruger et al (2005) identify three critical aspects which underpin Feigenbaum's concept of Total Quality Control. These are :

- Quality leadership as the motivating force for quality improvement;
- Using systems and processes to improve quality technology;
- Full commitment throughout the organisation in the quest for improving quality.

According to Summers (2009) Feigenbaum referred to quality as “a customer determination which is based on customer’s actual experience with the product or service, measured against his or her requirements – stated or unstated, conscious or merely sensed, technically operational or entirely subjective – always moving in a competitive market.” This broad definition of quality is versatile in its application. Intrinsic to this reference to quality is the emphasis on what the customer thinks of a product or service and not what the company thinks of it. One of the predictions contained within this work was that customer satisfaction would become an important factor, “even surpassing price” in decision-making. Over the years, this prediction has been realised in that customers have come to expect quality as an inherently fundamental dimension of a product or service for which they are paying (Evans & Lindsay 2005).

Pycraft et al (2004) highlighted two principal weaknesses in Feigenbaum’s theory of Total Quality Control. They point to the lack of discrimination between the various contexts within which quality control is applied and that different management theories are not holistically integrated. This implied that application of the Total Quality Control could not be homogenously and uniformly applied to all organisations as cultural and demographic considerations needed to be accounted for.

2.3.2 Crosby’s Zero Defect

According to Slack et al (2004), Phillip B. Crosby is best known for his work on the cost of quality. His ideas were encapsulated in a book he wrote called “Quality is Free”. Most organisations have not adequately quantified the cost of resources committed in undertaking incorrect processes or remedial activities where defects in products are identified. Those who have measured their costs have determined the costs to be in the region of approximately 30%. In his book, Crosby articulates the idea of a “zero defect” programme to reduce the cost of quality (Bamford & Forrester 2010).

Crosby’s quality philosophy was circumscribed by the following parameters

(Summers 2009; Kruger et al 2005):

- the “four absolutes” viz. defining quality in terms of conformance to requirements, quality system is about prevention, the benchmark of performance is zero defects, and the metric of quality is the price of non-conformance;
- the phrase that quality is free;
- the popularly known 14-point programme to ensure quality is embedded in the organisation’s operation. Crosby’s 14-point programme is not to be confused with Deming’s 14-point plan as the former documented a quality improvement programme and the latter developed a complete philosophy of management and not merely a quality management system.
- a simple approach to a range of quality related themes.

Naylor (2002) stated that Crosby’s improvement programme is fundamentally behavioural and relies on processes instead of statistical methods for quality management. The main criticism of Crosby’s approach is that it lacks detail on analytical methods for quality improvement. According to Pycraft et al (2004), other reference deficiencies in Crosby’s approach are highlighted in the implication that workers could be to blame for quality problems, that importance is placed on sloganeering instead of recognising real challenges, that inadequate attention is given to statistical methods, and that the zero defect concept may at times be considered as risk avoidance.

2.3.3 Deming’s System Stability

According to Bamford and Forrester (2010), the work of W. Edwards Deming highlighted the key role played by an organisation’s top management in improving product or service quality and defined quality as “continuous improvement of a stable system”. In his work, two important aspects were apparent viz. system stability and continuous improvement. System stability requires that all of the organisation’s systems in administration, design, production and sales need to be stable from a statistical perspective. For this to be effective there needs to be measurement throughout the organisation and monitoring over time. System stability is then determined when the measurements which have been instituted

yield a constant variance around a constant average. Deming's second aspect is the need for continuous improvement with the aim of reducing variation ultimately serving the goal of meeting the requirements of the customer (Schroeder et al 2010).

Unlike the observations of Schroeder et al (2011), Summers (2009), inferred that Deming stressed on the satisfaction of the customer in his definition of quality. Deming believed that listening to the needs of the customer is central to enabling the organisation to improve its products and services and that quality must be defined in terms of customer satisfaction (Summers 2009).

Like Crosby's 14-point programme referred to in section 2.3.2, Deming also had a 14-point plan to improve quality (Bamford & Forrester 2010; Pycraft et al 2004) although entirely different in content and import. Whereas Crosby's 14-point programme was directed at quality management, Deming's 14-point plan revolved around being a complete management philosophy (Kruger et al 2005). The main features of Deming's 14-point plan involved the need for statistical control methods, participative management engaging employees in decision-making, investment in training and education, transparency of purpose, strategy and methodology and purposeful improvement (Summers 2009; Pycraft et al 2005).

In addition to his 14-point plan, Evans and Lindsay (2005) highlighted Deming's idea of universal improvement methodology in what is termed as the Deming Cycle or PDCA Cycle. The acronym PDCA stands for Plan-Do-Check-Act where "Plan" means to begin by planning exactly what's required to be done to produce a product (includes design, processes, inputs, outputs, customer information, testing and action plans), "Do" means conducting minor experiments to explore solutions to potential problems that may arise, "Check" is a validity test to understand if ideas that are developed are practical and workable or need improvement and "Act" involves implementation where the prospect of success is realisable and to abandon the plan if not.

Slack et al (2004) pointed to several shortcomings in the concept of quality advanced by Deming viz. action plans and methodological principles were

sometimes vague; within the organisation, there appeared to be an idiosyncratic approach to leadership and motivation and his concept does not account for extraneous influences which were informed by political or coercive agendas.

2.3.4 Juran's Quality Trilogy

Naylor (2002) stated that in the 1950's Joseph M. Juran played a key role in the education of the Japanese on quality management concepts. Juran attempted to shift focus away from defining quality as "conformance to specification" towards a definition that portrayed quality as "fitness for use" (Barnes 2008; Summers 2009; Bamford and Forrester 2010). The important dimensions of Juran's quality philosophy are his definition of quality, his concept of breakthrough and the internal customer and his widely acclaimed quality trilogy. Other aspects attributed to his pioneering work are use of the Pareto Analysis for problem-solving, quality costs and the establishment of quality councils within organisations (Evans & Lindsay 2005).

Summers (2009) emphasised the creation of awareness about the need to improve as an integral part of Juran's thinking of quality management. Improvement in quality is underpinned by training in quality methods, establishing a team approach to problem-solving and recognising results. To Juran, the focus of quality management is expressed in the need to improve the entire system. For quality improvement to be effective, employees in an organisation need to be adequately skilled and need to understand how to apply techniques in the production process (Summers 2009)

In the process of refining his thinking, Juran articulated and advocated what has become a defining index of his ideas on quality management, popularly known as the quality trilogy (Kruger et al 2005; Summers 2009; Pycraft et al 2004 and Schroeder et al 2011). The three elements of the quality trilogy are quality planning, quality control and quality improvement. Figure 2.1 provides an overview of Juran's quality trilogy.

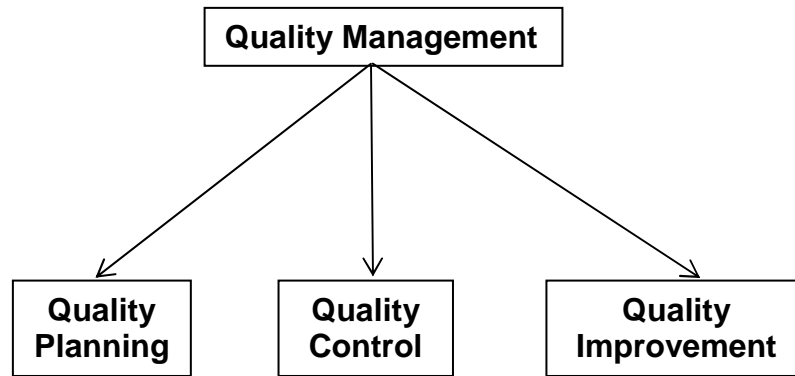


Fig 2.1 Juran's view of three legs supporting quality management

Adapted from Kruger, D., de Wit, P., & Ramdass, K. 2005. **Operations Management**. Oxford University Press, Cape Town. P200.

2.3.4.1 Quality Planning

With reference to Fig. 2.1, Hoyle (2010) argued that quality planning involves the provisions made to achieve the needs and expectations of an organisation's stakeholders, which includes customers, and in so doing prevent failures from occurring. Lindsay & Evans (2005) stated that the starting point for quality planning is the identification of an organisation's internal and external customers. The next step required is to transform the customer's needs into specifications, product attributes that conform to those needs and establishing processes that have the capacity to produce the product or service. Schroeder et al (2011) expanded on this by adding that in the planning stages companies should identify the major business goals, customers and product offerings.

2.3.4.2 Quality Control

Schroeder et al (2011) stated that Juran, like Deming, was a strong proponent of using statistical techniques in quality control. Management within organisations is required to institute procedures and methods needed to ensure quality and to work in keeping the system in control. Lindsay & Evans (2005) argued that this involves determination of "what is to be controlled, establish the control measurement and how they have to be measured, measure these performance variables, analyse the difference between the actual and the desired performance, and take remedial action." Naylor (2002) argued that as quality management is an organisation-wide

philosophy, greater emphasis should be placed on prevention controls and terms it “feedforward control”. This means that the inputs to each stage of a process must be correctly executed and this would have a favourable effect on the outcome. The two other forms of control involve concurrent quality control – monitoring as work takes place – and feedback quality control i.e. post completion inspections.

2.3.4.3 Quality Improvement

According to Bamford & Forrester (2010) Juran required statistical control of organisational processes to be instituted as a precursor for quality improvement to be effective as well as the simultaneous training and involvement of employees (Schroeder et al 2011; Summers 2009). According to Slack et al (2004), Juran suggested the idea of breakthrough improvement as the accomplishment of unprecedented levels of organisational performance.

In assessing the impact of Juran’s contribution to quality management, Wilkinson et al (1998) point to two main deficiencies in his approach. Firstly, there is a perception that Juran is not in support of “bottom-up” quality improvement initiatives which could imply that worker participation is considered marginal. Secondly, there is a view that Juran’s conceptualisation of quality management was underpinned by a preponderant reliance on control systems rather than on human intervention.

2.3.5 Ishikawa’s Quality Circles

According to Naylor (2002), Dr Kaoru Ishikawa was one of the first individuals to encourage total quality control. His definition of quality was broad and inclusive where focus should be on quality in every aspect of the organisation ie. information, process, service, price, systems and people. Bamford & Forrester (2010) stated that some of the characteristics of Ishikawa’s concept of quality management are the strong emphases placed on the importance of people and participation in the problem-solving process, a hybrid use of statistical and human-oriented techniques and the use of quality control circles. Heizer & Render (2011) pointed to the invention of the Ishikawa Diagram, also known as the cause-and-effect diagram, is used to find the root cause of problems in organisations.

Krajewski et al (2010) stated that the “7 tools” concept relates to the use of histograms, check-sheets, scatter diagrams, flowcharts, control charts, Pareto charts and cause-and effect diagrams to manage quality.

Ishikawa promoted the use of quality circles whereby teams from within the organisation would meet to review their work and solve challenges related to their own work. The membership of the quality circle is voluntary where participants receive training in the “7 tools”, determine appropriate problems to work on, develop solutions and establish new procedures to determine quality improvements (Summers 2009).

Wilkinson et al (1998) articulated two important criticisms of Ishikawa’s ideas: Firstly, that some of Ishikawa’s problem solving techniques could be construed as being overly simplistic and secondly, that his theory does not adequately describe how ideas developed within quality circles are externalised into action within the operations of the organisation.

2.4 Critique of Quality Pioneers Works

Although most authors on quality management acknowledged the pioneering role and influence of the early thinkers on quality management concepts, several aspects of their work has been subjected to critical scrutiny. These criticisms are highlighted below:

- The work of early quality management pioneers is replete with ideas that are fundamentally prescriptive in nature. Their work is challenged on the basis that there is insufficient analytical depth to the theoretical framework of their concepts. Universal assumptions are made which may not be applicable to individual organisations (Bamford & Forrester 2010; Naylor 2002);
- Operational managers and quality practitioners often adopt an uncritical approach to the implementation of ideas propounded by the early pioneers (Barnes 2008; Wilkinson 1998);
- Some of the writings of the early pioneers are in conflict with modern-day best practices. Over the years, organisational dynamics have evolved,

systems have assumed greater levels of sophistication and the ability to resolve problems has become considerably speedier. Whilst their specific recommendations may have been relevant to business operations at the time of their publication, modern operations require a re-think and adaptation of the underlying principles espoused by the quality pioneers (Kruger 2005; Slack et al 2004).

2.5 What is Quality?

In the preceding section, the historical genesis and the contextual framework for quality management was considered. The ideas developed by the main protagonists who have shaped the contours of our contemporary understanding of quality management were reviewed, critically appraised and evaluated. Attention in this section shifts to how historically formulated conceptualisations of quality have gained currency and expression in today's operations management environment.

2.5.1 Contemporary Definitions

The question of what is quality is a conundrum which is best encapsulated by Garvin (1988) where he stated "Quality is an unusually slippery concept, easy to visualise yet exasperatingly difficult to define." Various authors have posited differing conceptions of what quality may be. According to Heizer & Render (2011), satisfying customer requirements and meeting customer expectations is central to the quality of products and services. Customers are exercising greater discretionary power in their choice of products and services and are seeking-out value options in the market. Kruger et al (2005) stated that other requirements are reliability and consistency whereby service providers and product suppliers need to invest in formal systems to manage the quality of their end-products. The need for compliance to specifications, together with a documented, auditable and implemented quality management system form the cornerstone of assurance to customers that products are manufactured to an acceptable quality.

Chase et al (2006) argued against the reliance upon a singular definition for quality suggesting that it could prove to be problematic for organisations. Bamford &

Forrester (2010) stated that, “definitions and interpretations of what comprises ‘quality’ may vary considerably”. The basis of this position is that customer needs are changing and quality management needs to adapt according to customer dynamics. This is used to emphasise the initial point about customer centricity in the conceptualisation of quality.

According to Summers (2009) there are five key philosophical elements to the creation of a happy customer base. Firstly, organisations should be able to determine who their customers are; secondly, identify the critical success factors to meet the needs, requirements and expectations of their customers; thirdly, ensure that effective processes are established within their organisations to deliver on their customer’s requirements; fourthly, focus on measurement and improvement; And fifthly, provide the necessary management commitment and involvement within the organisation to succeed.

Wilkinson et al (1998) provided a different insight to quality by linking quality to competitive advantage by arguing that that quality is a key to achieving competitive advantage in the marketplace. Oakland (1993) pointed out that this dimension of quality is “the most important of competitive weapons”. This conclusion is derived by reviewing the gains of those companies which are committed to pursuing quality management systems against those who have not implemented quality programmes.

According to Krajewski et al (2010) total customer satisfaction and superior performance of an organisation need not necessarily be mutually exclusive within a quality paradigm. It is suggested that synthesis of total customer satisfaction and superior organisational performance may be achieved simultaneously by implementing quality programmes.

Slack et al (2004) identified quality as the single most important factor affecting an organisation’s performance relative to its competitors and defined quality as “consistent conformance to customer’s expectations”. In this definition, quality is limited to customer satisfaction and there is no link to organisational performance. The reference to other dimensions of quality is indirect and explained in the

deployment of the terms “conformance”, “consistent” and “expectation”.

The figure below provides a schematic overview of how the definition links the organisation’s operation with that of customer requirements.

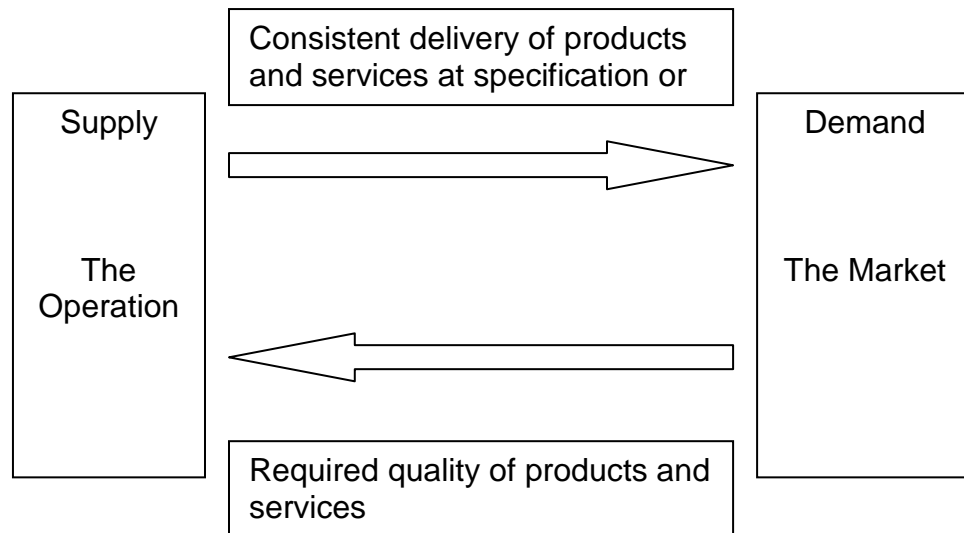


Fig 2.2 Quality Planning and Control

Adapted from Slack, N., Chambers, S., & Johnston, R. 2004. **Operations Management**. Pearson Education Limited, Essex. p592.

In Figure 2.2 from an operational perspective, the sum total of quality management within an operation is the desire to meet customer’s expectations. From the viewpoint of the customer, quality is a matter of perception which could be shaped by a myriad of internalised demographic, sociological and educational influences. This could lead to diametrically opposed perceptions of quality.

According to Heizer & Render (2011), the customer’s perception of quality is determined by engagement, interaction and experience with a product or service. If the product or service was better than what the customer perceived it to be, the customer is then satisfied with the high quality value. On the contrary, if the perception by the customer of a product or service is a negative outcome, customer dissatisfaction is experienced. How can this gap between customer perceptions of quality and operational expectations of quality, be bridged? Slack et

al (2004) proposed the creation of “a unified view” where quality can be “defined as the degree of fit between customer’s expectation and customer’s perception of a product or service”. Within the organisational domain, the challenge for the operational side is to identify all those controllable and manageable elements which determine the gap between customer’s expectations and perceptions.

Schroeder et al (2011) stated that quality is defined in terms of the customer perspective, as meeting and/or exceeding customer requirements at the present and into the future. The cross-functional nature of quality management is highlighted in that it cross-cuts and intersects with the entire organisation. On the other hand, operation of the organisation concentrates on product delivery and does not necessarily involve all other facets of the organisation such as marketing, administration, finance and human resources.

Bamford & Forrester (2010) describe quality as a function of two elements viz. specified design and conformance to the specified design. In this definition of quality, emphasis is inherently placed on control techniques deployed to achieve quality objectives viz. inspections, testing procedures, quality control interventions and audits. Underpinning this approach is the use of statistical process control methods. Allied to the regime of control measures is the act of expediting quality assurance requirements via assessments of conformance to design specifications. The quality assurance policies of an organisation may be viewed as a detection system i.e. ensuring that a service or product is delivered correctly the first time-around. Schroeder et al (2011) argue differently in that quality is defined in terms of customer satisfaction and position the customer as the sole arbiter of determining what quality is. So long as the customer is satisfied, the product or service supplied is fit-for-purpose.

Hoyle (2010) reviewed definitions of quality from several experts and sources. In considering the variations in the definition, an eclectic construct was proffered that included freedom from deficiencies, fitness for use, fitness of purpose and sustained satisfaction within the domain of quality. This definition of quality was afforded the widest possible meaning.

2.5.2 Straker's Value Exchange Concept

The discussion on quality in this section is centered principally around total customer satisfaction and operational excellence to meet customer requirements. Straker (2011) advances a significantly different approach to understanding quality in terms of value exchange. What is the basis of this argument? Straker (2011) states that at the simplest level, quality is about asking “what is wanted” and “how do we do it”. He argues that based on traditional definitions of quality, some theories of quality articulated by quality experts are fundamentally challenged. For example, Crosby’s “conformance to requirements” will be undone if the “requirements” in themselves are incorrect in a way that failure will be a certainty. Juran’s “fitness for use” concept presupposes that there is prior knowledge on the way the product will be used. This is not always possible or foreseeable. In ISO’s quality standards, reference is made to “implied need” yet this is considered to be a “simplistic and single minded focus”. Contemporary quality models avoid pegging down narrow definitions and tend to adopt a wider more generalised business view. (What is Quality ... 2011).

From the above, it seems that there is an acknowledgement of the difficulties with holistically and comprehensively defining quality with nearly every attempt to do so. There is always an angle or dimension of quality that is excluded in the attempts to define it, as language is pointed out to be the single most important constraint. Two questions may be posed here:

- What if products continue to conform to requirements but do not sell?
- What if customers are fully satisfied with the product quality but production costs exceed profitability?

Taking into account theories of quality developed by the pioneers of quality management, Straker (2011) proposes the idea that quality means staying in business. What then about business growth? It can be argued that business is not only about the business operation and its customers but a plethora of other stakeholders viz. shareholders, employees, customers, suppliers, partners and governments, all engaged in a complex web of value exchange (What is Quality ... 2011).

According to Straker (2011) quality is defined as “understanding and optimising the whole system of value exchange”. It implies that there should be a full understanding of how business operations function, individually and as interconnected systems, understanding people and their values and their manner of trade with others. Lastly, it implies knowing “imperfect systems can be optimized” to enable businesses to remain sustainable in the long term (What is Quality ... 2011).

2.5.3 Quality Defined by International Bodies

According to the UK-based Chartered Institute of Quality (CQI), “quality management is an organisation-wide approach to understanding precisely what customers need and consistently deliver accurate solutions within budget, on time and with the minimum loss to society.” By this is meant that quality is about customer needs that are effectively designed via processes through the product life-cycle and delivery of the product is ensured in accordance with the defined processes. How is this achieved ? The definition incorporates all process element measurements, systematic performance analysis and continual improvement of processes, products and services. Quality is considered to be integrated into business management and is premised on innovation and care (What is quality... 2011).

How does the American Society for Quality (ASQ) define quality? The ASQ uses the term “subjective” in their attempt at defining quality in reference to the multitude of prevailing definitions proffered by quality management practitioners, experts and organisations. However, the ASQ does peg two dimensions of quality which informs their definition of quality. The first is “characteristics of a product or service that bear on its ability to satisfy stated or implied needs”, and the second, “a product free of deficiencies”. The ASQ reverts to Juran’s “fitness for use” and Crosby’s “conformance to requirements” statements to afford some measure of substance to the definition of quality (Basic Concepts in Quality ...2011).

The ISO 9000 family of quality standards is widely and extensively used by numerous organisations in South Africa to manage quality within their operations.

What is the ISO definition of quality? ISO 9000 : 2000(E) defines quality as the “degree to which a set of inherent characteristics fulfills requirements.” Within its body of definitions, ISO 9000 unpacks specific words within this definition to contextualise its meaning. The word “inherent” in the definition means an integral part of something which is of a permanent nature. The word “characteristics” may be assigned, inherent, qualitative or quantitative. Typically, characteristics may be physical, behavioural, temporal, ergonomic or functional in nature. The word “requirements” in the definition may be a need or expectation that is stated, generally implied or obligatory. Requirements may be manifold viz. a product requirement, a quality management requirement, a customer requirement or a specified requirement (ISO 9000 Essentials ... 2011).

2.6 Approaches to Quality Management

As discussed in Section 2.4, one of the major problems when using the word “quality” is that depending on context, it could mean different things and remain open to interpretation (Barnes 2008). This is one of the reasons why customers have come to experience variations in the level of quality in products and services. With this consideration in mind, Garvin (1988) categorised quality definitions into five different and distinct approaches to quality management viz. Transcendent-based approach, manufacturing-based approach, user-based approach, product-based approach and value-based approach (Evans & Lindsay 2005; Slack 2004; Pycraft et al 2004; Kruger et al 2005; Barnes 2008). Figure 2.3 is a graphic overview of the five approaches.

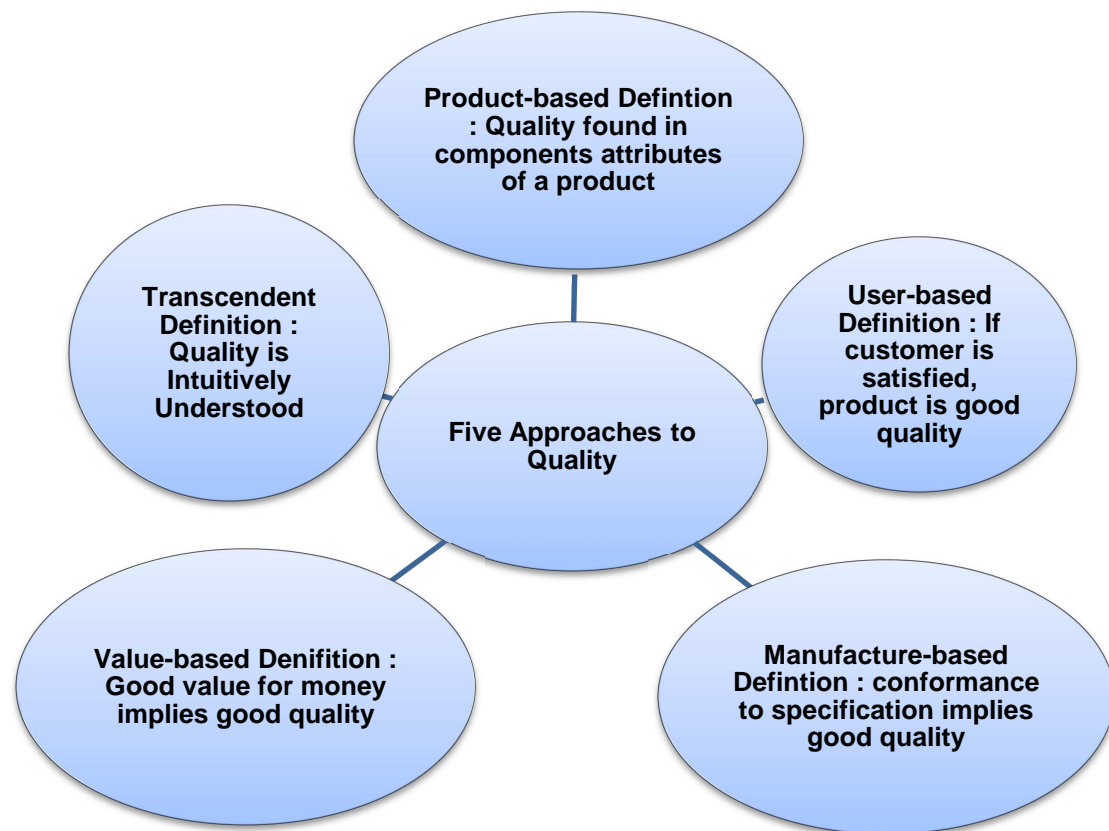


Fig 2.3 Garvin's definition of product quality highlights five major approaches

Adapted from Kruger, D., de Wit, P., & Ramdass, K. 2005. **Operations Management**. Oxford University Press, Cape Town. P173.

The five approaches shown in Figure 2.3 are discussed below:

2.6.1 Product-Based Approach

According to Barnes (2008), a product has certain attributes which are inherent in its design-base and may be precisely measured. Following this definition, the superior quality of the product is determined through measured criteria. The emphasis is on product precision. There is also the real danger of an over-concentration in developing what designers may consider to be superior attributes of the product without regard for testing these with customers' perceptions (Barnes 2008; Slack 2004).

2.6.2 User-Based Approach

Evans & Lyndsay (2005) stated that this approach to quality is determined by fit-for-use purposes as seen by customers or end-users. Based on the fulfillment of

the customer's requirements, the customer's perception decides ultimately on the quality of the product. This approach requires that products and/or services not only adhere to specifications but also, concerns itself with the appropriateness of the specifications for the customer (Pycraft et al 2004).

Barnes (2008) argued that in mass markets, there may arise inconsistencies in this approach as a result of a few customers' perceptions of quality being radically different to the majority of the customers who may be satisfied with product quality. This approach can also lead to the desire of the organisation to provide the customer with whatever is wanted irrespective of whether these requirements are cost effective or consistently reproducible.

2.6.3 Manufacturing or Operations-Based Approach

Pycraft et al (2004) stated that in this approach-quality is defined in terms of conformance to specification. The product quality is evaluated according to the specification determined by the designer of the product. This approach requires the product to be free of errors. Quality is fully realised when the product is produced free of defects and if all activities and systems in the production process work correctly first-time-around.

According to Kruger et al (2005) operations personnel are disconnected from the customer base. Thus, there is the inherent danger of preoccupation with improving production processes without consideration for the possibility of introducing new products or expanding product diversity.

2.6.4 Value-Based Approach

Slack et al (2004) stated that this approach is subtly different from the User-based approach in that product cost or price bears some influence to perceptions of quality. Product quality is considered to be superior, based on value-for-money benefits for a specific product. Customers may be prepared to accept products with a lower specification if the price is low. One of the key disadvantages of this approach is the conflict between meeting cost and quality objectives. Employees within the organisation may consider achieving cost savings as a measure of

product success. However, product quality could become compromised (Evans & Lindsay 2005).

2.6.5 Perceived or Transcendent-Based Approach

Kruger et al (2005) stated that quality in this approach is based on inherent or innate attributes of excellence. Unlike other approaches, it is neither tangibly expressed nor easily describable or communicable but aesthetically appreciable. Superior quality may be identified by the feel, look or touch of the product. In the case of services, superior quality may be considered in terms of ambience or other ethereal dimensions. This approach is considered to be immensely difficult to operationalise due to the subjectivity of the intangible factors influencing or determining the superior quality of a product.

In the abovementioned five approaches there is no singularly correct approach to quality and each of the five approaches can raise problems if viewed to the exclusion of the others. The absence of a universal definition of quality may cause different functional areas of an organisation to have varying interpretations to the appropriate approach required for quality management. However, it is evident that whichever approach to quality management is used, satisfaction of the customer's requirements must hold central consideration. Comprehending, understanding and meeting customer requirements and/or expectations is a necessary pre-requisite for successfully managing quality (Summers 2009; Wilkinson et al 1998).

2.7 Total Quality Management (TQM) in Operations

According to the American Society for Quality, in the 70's many of the industrial sectors in the USA were surpassed by competition from high quality Japanese organisations especially in the automotive and electronics industries. The response from U.S. companies was no longer an emphasis only on statistical quality control but a comprehensive approach that incorporated the full breadth of the organisation. This approach became known as Total Quality Management (History of Quality... 2011).

Chase et al (2006) argued that TQM is about managing an organisation in such a

way that it excels in every dimension of its products or services that are important to the customer. By adopting the TQM approach, the entire organisation becomes committed to achieving two primary goals viz. meticulous design of the product and consistent reproduction of the design by ensuring the integrity of organisational systems.

Naylor (2002) stated that TQM is a philosophy of quality that creates a linkage between an organisation's policy with its operational practices where the word 'total' suggests there is wholehearted commitment, quality means continuously exceeding customer's expectations and management means an active process led by executive management. TQM is considered to be more than an operations activity and is interwoven into the fabric of the organisation. Thus, the pursuit of its objectives becomes the responsibility of every employee and department within the organisation. Heizer & Render (2011) stated that TQM encompasses the entire organisation and involves a complete orientation of every activity towards satisfying customers and creating value for all its stakeholders. Its aim is customer satisfaction through scientific analysis of business processes with the objective of continuously correcting and preventing errors through involvement of all employees in the organisation.

Krajewski et al (2010) stated that TQM is a philosophy that is underscored by three basic principles viz. customer satisfaction, employee involvement and continuous improvement. Other important elements of TQM alluded to are process design, process-solving tools, purchasing and benchmarking. Fig 2.4 below is a graphic representation of the three TQM principles.

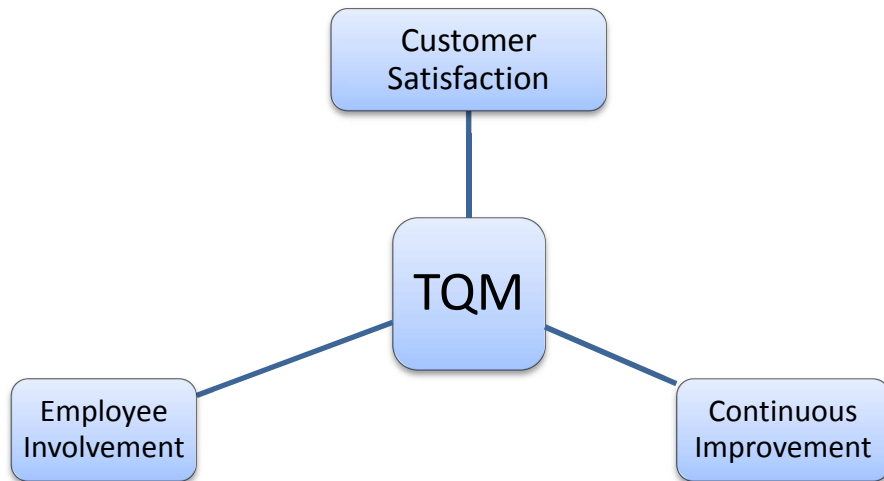


Fig 2.4 Three Principles of TQM

Adapted from Krajewski, L.J, Ritzman, L.P., & Malhotra, M.K. 2010. **Operations Management Processes and Supply Chains**. Pearson Prentice Hall, New Jersey. P198.

The first principle referred to, is customer satisfaction which is an all-encompassing term representing a group of attributes viz.:

- Conformance to specifications;
- Value of a product or service for which customers are willing to pay a price;
- Fitness for use which customers use to determine how well a product or service performs its intended purpose;
- Support provided by a company for its product or service is sometimes considered to be almost as important as the product itself;
- Psychological impressions which customers may develop based on intangible attributes relating to image or aesthetics.

Heizer & Render (2011) stated that TQM places the customer at the forefront of decision-making. All processes and systems within the organisation are aligned to ensure the customer's expectations are fully met which enables the organisation to compete as a leader in world markets.

The second principle is the role of employee involvement identified by Krajewski et al (2010) wherein employees may influence quality:

- Definition of internal and external customers which every employee needs to be able to identify;
- Correcting errors at the point in the operation where they occur is known as managing quality at the source;
- The use of teamwork for small groups of employees who are directed towards achievement of predetermined goals;
- Empowerment of employees through delegation of decision-making powers to solve operational challenges within their area of responsibility

Muhlemann, Oakland and Lockyer (1992) stated that for the organisation to be effective, each person, department, level and activity needs to work together because “every person and every activity affects and in turn is affected by others.” Evans and Lindsay (2005) suggested the notion of internal customers and suppliers where everyone in the organisation is considered to be either a supplier of goods and services to other internal customers or a consumer of goods and services. By implication, the external customer will be satisfied with the product or service if the organisation’s own internal customers are satisfied.

Krajewski et al (2010) stated that the third principle which forms the basis of TQM is continuous improvement. This element will be reviewed in more detail in Section 2.10. According to Hoyle (2010), continuous improvement is about an organisation investing resources in and maintaining focus on increasing its ability to fulfill quality requirements.

Barnes (2008) introduced two other dimensions of TQM. The first is that TQM goes beyond the mechanistic systems, processes and tools of an organisation for quality to become internalised within the belief and value system of the every employee. A complete culture change is advocated whereby each employee is not just restricted to conform to requirements but motivated to exceed customers’ expectations. Barnes’ second dimension is how TQM plays a pivotal role in maintaining the competitiveness of an organisation. It is premised on the belief that quality defined from a customer’s perspective and driven by the pursuit of improvements in quality will also result in the enhancement of operational performance. TQM is often implemented as response to the perception of the emergence of competitors and thus represents an attempt at sustaining

competitive advantage (Wilkinson et al 1998).

Barnes (2008) concurs with Chase et al (2006) and Pycraft et al (2004) on the criticality of involving every member of an organisation to achieve its quality objectives. There is unanimity amongst Wilkinson et al (1998), Pycraft et al (2004), Chase (2006), Barnes (2008) and Krajewski et al (2010) that continuous improvement, customer focus and employee involvement are fundamental tenets of TQM. For TQM to be successful, it requires complementary support by a visible demonstration of commitment from top-management, a healthy industrial relations environment, clear intra-organisational communication, positioning as a learning organisation, sound relationships with customers and suppliers, fostering an atmosphere conducive to innovative thinking within the workforce, evaluating costs associated with quality, getting “things right first time” instead of engineering defects into products to be corrected later, and developing systems and procedures to enhance quality improvements (Slack 2004; Barnes 2008).

Hur (2009) stated that a study was conducted on South Korean government employees to investigate the quantitative and qualitative differences between the total quality management participants and non-participants. The study was based on the three dimensions of TQM viz. employee empowerment, continuous improvement and creation of a new organisational culture. Figure 2.5 below graphically represents the three dimensions together with the interrelated TQM sub-elements.

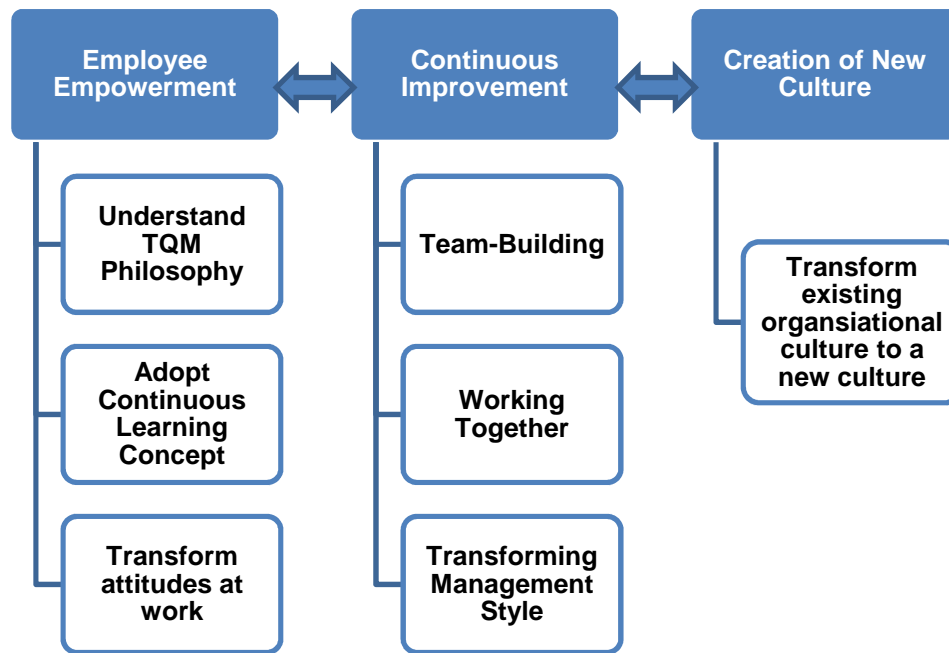


Fig 2.5 Three Dimensions of TQM and its Objectives

Adapted from Hur, M.H. 2009. **The Influence of Total Quality Management Practices on How Organisations Work**. Total Quality Management & Business Excellence. Vol. 20, No. 8, P.850

Hur (2009) stated that from the employee empowerment dimension, three sub-elements evaluated by the study were: understanding TQM philosophies, adapting and utilising the continuous learning mechanism of TQM in an organisation, and transforming attitudes toward value-added practices.

Hur (2009) concluded that there is there is “strong support for the framework of TQM practices.” Why is this so? The reason is principally because the study showed that the “total quality management practices have let government employees change their attitudes at work from a rule-of-thumb estimate to a rational judgment style on the basis of analysis, their learning mechanism from individual to collective learning, their decision-making style from the individual-based to the team-based type.” The results of the study also showed that the application of TQM enabled Korean Government employees to re-think their concept of quality services in an unprecedented way. This review of the way of working facilitated a transformation in their individual attitudes at work, promoted their knowledge of quality service and customer satisfaction, adopted a teamwork

approach and recreated a new organisational culture.

In the aforementioned discussion on TQM, attention was given to the TQM model and by way of research study, an example was highlighted on the effect of TQM on an organisation. Wilkinson et al (1998) raised some interesting questions about the applicability of TQM:

- Can TQM actually work in operations management?
- Does TQM have universal applicability?
- What role, if any, does TQM play in quality and transformational change?
- Is TQM a managerial “flavour-of-the-month” type intervention?

According to Wilkinson et al (1998), there is evidence to suggest that implementation of TQM is not without its challenges and often successful implementation has been difficult to achieve. However, where full implementation of TQM principles has been achieved, it has had a significant impact on organisational success. According to Bamford & Forrester (2010), when viewed as a management philosophy, TQM can have a positive influence provided it is customised for the sector in which it is being applied. Where companies have experienced crises, often TQM was considered to deliver a major re-orientation of the organisation and thus ensure long term sustainability. TQM is a management philosophy that requires systemic application which needs to be rooted in the culture of the organisation as opposed to a superficial consideration to solve peripheral operational problems.

2.8 What are Quality Gaps?

In the preceding sections, attention was drawn to firstly, the difficulties associated with defining quality and secondly, the various approaches to quality management based on perceived orientation or need of the organisation. Much of the difficulty has to do with the array of perceptions on what constitutes quality and consequently on how it should be appropriately managed. One of the main reasons why quality problems arise is when the customers' perception of a product or service fails to match the expectations required of it (Pycraft et al 2004). Any shortfall between what customers expect and what they perceive they are getting may result in customer dissatisfaction (Barnes 2008). This is known as a quality

gap.

What are the different types of quality gaps that commonly occur in organisations?

2.8.1 Gap 1 – Customers' Specification vs Operations Specification

Slack et al (2004) stated that if there is discordance between the customers' specification and the organisation's own internal specification, there could result a perception of poor quality. According to Barnes (2008), this is usually a sign of management's lack of understanding of what is important to the customer and this gap may be overcome by ensuring there is consistency between the product specification and the customers' expectation of the product typically by the marketing, operations and product/service development departments.

2.8.2 Gap 2 – The Concept vs Specification

According to Barnes (2008), if a concept for a service or product is developed and the way the specification has been established by the organisation does not fulfill the original conceptual requirements, there may be a perception of poor quality. Pycraft et al (2004) stated that this gap may be mediated by aligning the internal departments such that the internal specification meets the intended concept.

2.8.3 Gap 3 – Quality Specification vs Actual Quality

Slack et al (2004) stated that a quality gap may arise due to the mismatch between the specification of a product or service and the actual delivered quality of the product or service. Several reasons may account for this phenomenon viz. demand could be greater than anticipated, the specification could be inappropriate, the specification could be beyond the capability of the organisation's resources, effective controls may be lacking, poor training of staff or inexperienced employees.

2.8.4 Gap 4 – Actual Quality vs Communicated Image

According Pycraft et al (2004) perceptions of poor quality may also arise in the minds of customers if the actual product does not reflect its marketed image or

advertised attributes. This may be remedied by the organisation evaluating its operations to determine if it is able to deliver on its promises. Barnes (2008) stated that it is more advantageous to promise customers only what the organisation is able to deliver i.e. under-promise and over-deliver.

2.8.5 Gap 5 – Customers' Expectations vs Customers' Experience

According to Barnes (2008), customers' expectations are shaped and informed by images portrayed by suppliers, recommendations of others and by their own experiences. Ultimately, customers form their own perceptions and not by those supplying the product which makes it essential for suppliers to adopt an empathetic view of the customers' perspective.

2.9 What does Cost of Quality Mean?

According to Bamford & Forrester (2010) many companies invest vast resources in processes, systems and skills to improve the quality of their product or service. The aim is to ensure that quality is in accordance with the requirements and needs of the customer. Krajewski et al (2010) stated that when a customer is dissatisfied with a product, it points to some failure in the production process. This requires the organisation to commit expenditure to close the gaps at the points in the process where failure is prevalent. Barnes (2008) argued that quality is measured in two ways viz. operational measures and financial measures. Cost, in financial terms, affects the corporate financial performance of the organisation. Schroeder et al (2011) stated that quality and financial performance are interrelated. Costs to improve quality may be equated to the expenditure required in any of the other improvement proposals.

According to Pycraft et al (2004), all organisations would consider quality management to be advantageous to their operational success but there is a cost associated with implementing quality programmes. These costs could become considerable depending on the span and depth of application. However, there are clear benefits to be gained from incurring such expenditure. The idea behind quantifying costs of quality is that it can be managed and controlled as any other cost in the organisation (Schroeder et al 2011).

According to Schroeder et al (2011) it has been found that the cost of quality is about 30% of the total sales of those organisations who have accurately measured costs but could range between 20% and 40%. As these figures are often twice or thrice the profit margins of most organisations, any reduction in the cost of quality will result in a considerable increase in the profit margins. In efficiently managed organisations, it has been found that the cost of quality may be reduced to about 3% while simultaneously improving product quality.

Hoyle (2010) stated that quality costs are incurred because failure of a product or service is possible. The actual cost of producing a product is the “no failure cost plus the failure cost”. Kruger et al (2005) stated that there are essentially four types of cost associated with ensuring quality viz. prevention costs, appraisal costs, internal failure costs and external failure costs (Bamford & Forrester 2010; Evans & Lindsay 2005).

2.9.1 Prevention Costs

According to Naylor (2002), prevention costs are costs which are incurred by the organisation when ensuring that defects, mistakes, failures and errors do not occur. Typically, they include the costs of re-designing processes in order to remove the causes of poor performance, simplifying production, investment in skills development and working with external commodity suppliers or service providers to enhance their quality management systems. To prevent defects from occurring, it is incumbent on the organisation to incur additional expenditure (Krajewski et al 2010; Chase et al 2006). Bamford and Forrester (2010) stated that prevention costs may also be extended to include development costs for a new product, reliability studies and prototype tests. Reliability studies could involve planned failure investigations with the objective of identifying the root cause of endemic quality problems. (Schroeder et al 2011; Barnes 2008). By introducing a quality management system, prevention costs increase but this may be offset and justifiable in the reduction of total quality costs (Kruger et al 2005).

2.9.2 Appraisal Costs

According to Summers (2009), appraisal costs are associated with quality control, sample testing and quality assurance which requires inspections to check for conformance to specifications (Barnes 2008; Chase et al 2006; Kruger et al 2005). Typically, these costs include inspection tests, checks of incoming material, inspection of equipment, assessment of suppliers, final product inspections and costs of maintaining laboratories for testing. (Schroeder et al 2011). In addition, Pycraft et al (2004) included the cost of conducting customer surveys as a part of appraisal costs. An increase in prevention costs will result in a decrease of appraisal costs as less resources will be required to undertake quality inspections (Krajewski et al 2010)

2.9.3 Internal Failure Costs

Krajewski et al (2010) stated that these are costs that are caused by errors and defects within the processes and systems of the organisation. These defects are usually discovered in the production process where there is a failure to achieve pre-determined standards (Chase et al 2006). Costs that may be included in this category are the cost of scrap, rework costs, downgrading of product to second grade, lost production time and costs of carrying additional contingency materials to compensate for defective products (Schroeder et al 2011, Bamford & Forrester 2010).

2.9.4 External Failure Costs

According to Heizer & Render (2011) external failure costs are costs incurred due to defective items being passed through the system and only discovered once the service or product reaches the customer. This is caused by products and services not meeting quality standards as perceived by the customer (Schroeder et al 2011; Chase et al 2006). These costs may be tangible or intangible which includes loss of customer goodwill impacting on future business prospects, time loss due to investigation of customer complaints, administration of product recalls, the costs of meeting warranty commitments, costs of concessions made to customers and possible costs incurred related to litigation (Barnes 2008; Bamford & Forrester 2010; Slack 2004).

2.10 Operational Improvement

Evans & Lindsay (2005) stated that activities and processes in an operation, irrespective of how well managed, have aspects that can and may be improved. Bamford & Forrester (2010) stated that there is an acknowledgement on the part of organisations that physical inspection of products and post-production remediation of defects are not in themselves guarantees of quality. There is a need to constantly review the processes and systems to improve products and services. As found in Section 2.3 of this Chapter, for those who were influential in developing quality management concepts, quality improvement was a key focus area e.g. Deming developed what became known as the “P-D-C-A or Deming Cycle”; Crosby articulated the concept of the “14-step programme” to improve quality; and Juran advocated the idea of the “breakthrough sequence” (Naylor 2002).

According to Schroeder (2011), organisations use several methods and tools to expedite quality improvement programmes such as flowcharts, data trends, check sheets, cause-and-effect diagrams, control charts, business process re-engineering, benchmarking and use of failure-mode-and-effect (FMEA). However, there are essentially two strategic approaches to improvement: breakthrough improvement and continuous improvement (Schroeder et al 2011; Chase et al 2006; Evans & Lindsay 2005).

2.10.1 Breakthrough Improvement

Lindsay and Evans (2005) argued that breakthrough improvement is innovation-based and requires a dramatic change in performance on the operational side. Slack et al (2004) stated that the impact of breakthrough improvements is sudden and results in a step-change in operational performance. Improvements of this nature are often capital intensive, have a disruptive impact upon existing operations of an organisation and frequently require changes in the deployment of technology. A major criticism of the breakthrough improvement philosophy is the time-delay that passes before results are achieved (Pycraft et al 2004). Figure 2.6 offers a graphic description of breakthrough improvement where significant step changes are initiated over a period of time. On each occasion, the organisational

performance is located at a new and higher level.

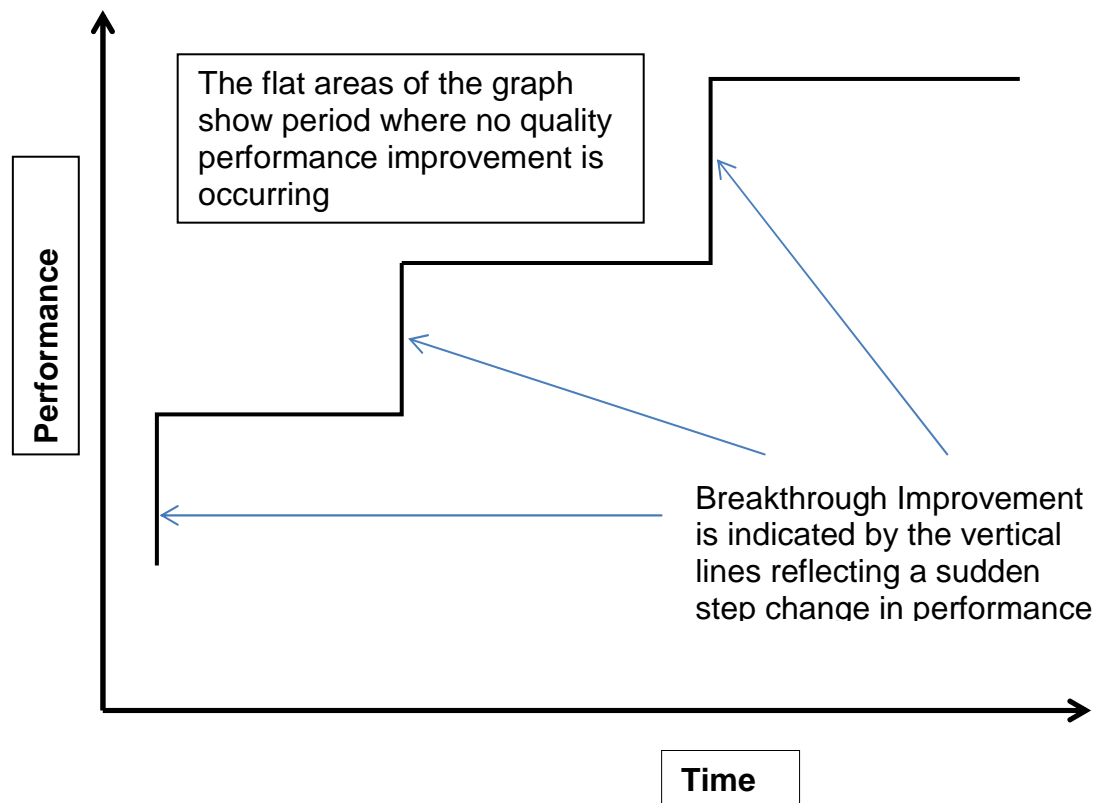


Fig 2.6 Performance Improvement with Breakthrough Improvement

Adapted from Pycraft et al. 2009. **Operations Management**. Pearson Prentice Hall, New Jersey. P665.

In Fig. 2.6, the vertical axis represents performance improvements in an organisation's systems and processes while the horizontal axis represents passage of time over which improvements are instituted. The arrows denote breakthrough improvements indicating the points in time when there are major step changes in the performance of the organisation. Following each step improvement, there is a "flat" period which reflects a period of stability.

2.10.2 Continuous Improvement

According to (Summers 2009) another important strategic approach to improvement is known as continuous improvement. A Japanese quality specialist, Mazak Imai, coined the term "kaizen" which meant continuous improvement of quality (Bamford & Forrester 2010). The emphasis was on constant, incremental and perpetual improvement of quality. Kaizen focuses on implementation where a project is not considered complete until the results have been achieved and

consistently maintained. Importance is placed on iterative improvement instead of the magnitude of improvement steps (Naylor 2002). Chase et al (2006) defined continuous improvement in terms of sites where improvement initiatives are implemented like continual improvement of machinery, materials, labour and production methods. Krajewski et al (2010) stated that continuous improvement involves identifying benchmarks for excellence and imbuing employees with a sense of custodianship in the improvement process.

Krajewski et al (2010) argued that continuous improvement relies on frequent and small incremental enhancements to processes and systems. Figure 2.7 provides a graphic representation of the small incremental improvements that form the basis of continual improvement. The rate of improvement is not considered as critical as the effectively realisable change that is experienced (Barnes 2008; Slack et al 2004). Wilkinson et al (1998) argued that meeting customer requirements necessitates the implementation of continuous improvement whereby all the employees in the organisation are involved in the improvement process.

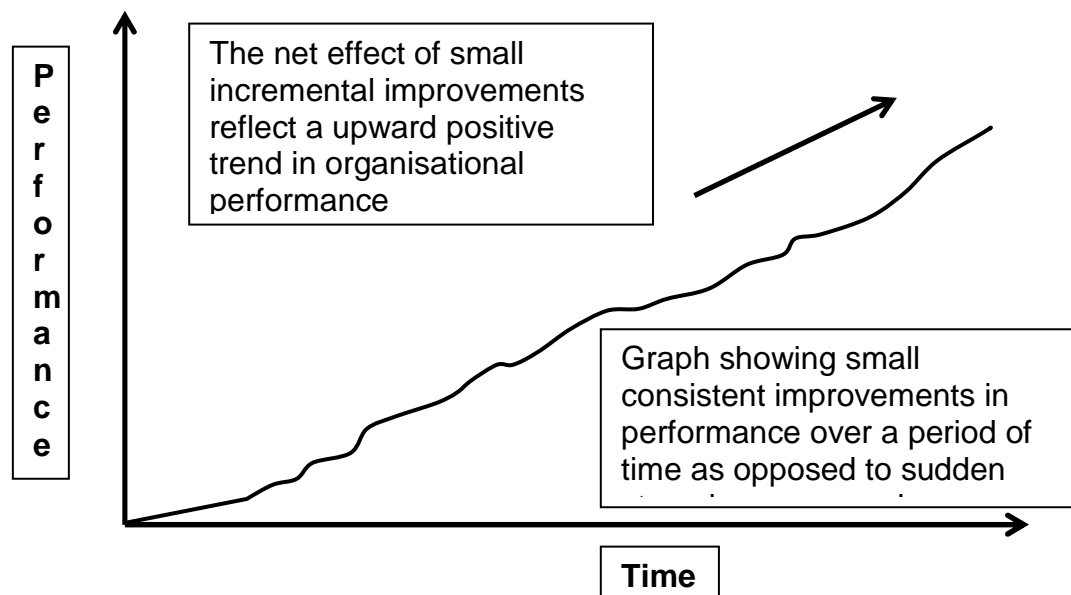


Fig 2.7 Performance Improvement with Breakthrough Improvement

Adapted from Pycraft et al. 2009. **Operations Management**. Pearson Prentice Hall, New Jersey. P666.

In Fig. 2.7, the vertical axis represents performance improvement of the organisation while the horizontal axis represents time duration of the improvement

process. As small changes are introduced to enhance performance, so does the net overall performance of the organisation improve.

According to Schroeder (2011), not all processes in an organisation require to be improved but there should be a prioritisation of the strategically important ones. Barnes (2008) argued that there should be some degree of discretionary decision-making prior to embarking on an improvement initiative based on three key issues viz. the scale and scope of the improvement needed, the priority elements of the performance improvement and the appropriate approach required to succeed.

Heizer & Render (2011) stated that continuous improvement may be viewed as an infinite process of repeated questioning of the detailed process or activity. According to Krajewski et al (2010), most organisations engaged in continuous improvement use the plan-do-check-act cycle in their approach to problem solving. This cyclical nature of continuous improvement may be graphically represented by an improvement cycle, commonly known as the PDCA Cycle, also known as the Deming Cycle shown in Figure 2.8 (Heizer & Render 2011).

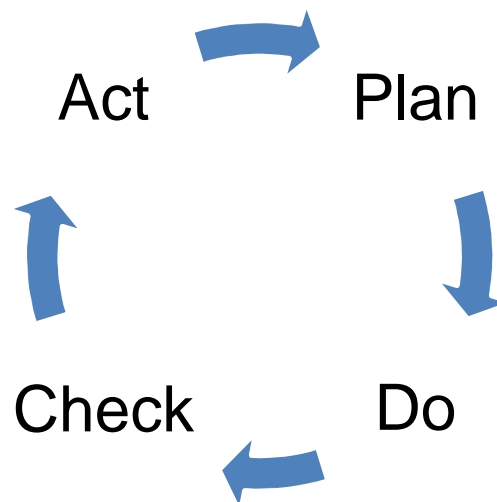


Fig 2.8 Plan-Do-Check-Act Cycle

Adapted from Heizer & Render. 2011. **Operations Management**. Pearson Education, Inc. New Jersey. P227.

The P-D-C-A Cycle may be explained as follows (Krajewski et al (2010); Slack et al 2004):

- **Plan** – the cycle usually commences with the planning stage which focusing

on a specific area of an organisation which needs improvement. The quality improvement team thereafter analyses all data, systems and processes applicable to the area in question. Once the analysis is completed, the team sets quality improvement goals together with a set of metrics for measuring progress towards achieving the goals.

- **Do** – This stage involves implementation of the plan within the operation. Data for the processes is recovered for future analysis.
- **Check** – The data retrieved during the “Do” stage is analysed and metrics established in the planning stage are monitored for signs of progress and any refinements required are integrated into the improvement plan. There could be a decision at this stage to terminate the project based on the success of the results achieved.
- **Act** – Based on the success of the improvement programme, the quality improvement team documents the results and revises the processes such that the improved process becomes the new standard of the operation. Should the programme be unsuccessful, the lessons derived from the trial are studied and the cycle re-commences without the mistakes of the initial trial.

Some key questions need to be answered on quality improvement programmes. What are the potential pitfalls of quality improvement programmes? Are all operational quality improvement programmes implemented for the correct reasons? Do all quality improvement programmes deliver the expected performance improvement in products and services? According to Bamford and Forrester (2010), many improvement programmes assume that the workforce is compliant and therefore internalises the aims, objectives and practices of the organisation’s programmes. This is not necessarily so especially if the improvement programme is foisted upon the workforce in a top-down coercive manner. Secondly, there could be superficial motives on the part of senior management to publicise improvement programmes viz. to placate customers that the organisation is committed to quality improvement when in reality, underlying organisational problems are masked by the veneer of a commitment to quality. Thirdly, implementing quality improvement

programmes is often associated with a culture of authoritarianism where there is little space for criticism and appraisal (Hoyle 2010; Summers 2009; Pycraft 2004).

2.11 Summary

The literature selection of this Chapter was focused on quality management in relation to business operations. This approach was used due to its relevance to the objective of the research study which focused on an understanding of supplier's perceptions of quality management as applied to their provision of products and services to Eskom. There is a vast body of literature that related to quality management in general but this was deemed superfluous and irrelevant to the specific topic of this research project.

In this chapter, the conceptual framework of quality management in operations is developed. The edifice, upon which quality management in business operations is founded, is shaped and informed by the historical work of quality management pioneers. Feigenbaum, Crosby, Deming, Juran and Ishikawa (among others) developed the intellectual paradigm for application of quality management principles in modern business operations. Over the past thirty years, organisational dynamics have evolved and this has necessitated an adaptation of the early pioneers' ideas.

"Quality" is a term which has neither a universally accepted definition nor a uniform interpretation. Depending on context, expectation and application, the term "quality" is used with varying nuances. A number of authors and organisations have articulated different definitions of quality. These definitions include meeting customer needs, exceeding customer expectations, conformance to specifications, achieving superior operational performance, enabling competitive advantage and a more radically different interpretation in terms of value exchange. Business operations quality management approaches are based on the specific interpretations of quality. The Total Quality Management (TQM) concept is an all-embracing and all-encompassing approach to quality management which involves and affects every facet of business operations.

Quality gaps in operations occur when there is discordance between what is expected of products and services, and what is actual fact delivered to the customer. To prevent defects in products and services, business organisations invest considerable resources in minimising such occurrences. This is known as the cost of quality. Quality of products and services is improved by either breakthrough improvement or continuous improvement techniques.

In the Chapter 3 the specific research methodology used in this study is afforded detailed attention.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

Business research involves investigation of a specific problem with a view to deriving a solution for that problem. Research provides the basis upon which knowledge is developed, enables the accumulation of knowledge to solve problems and to aid in decision-making (Goddard & Melville 2006). In large contemporary organisations, business processes have become increasingly complex and it has become imperative that useful information is readily available. According to Blumberg, Cooper & Schindler (2005), there are three main factors which precipitate the need for research viz. the need for improved quality of information as decisions become more complex, the availability of improved techniques and tools to satisfy this need and to avoid the possibility of accumulating superfluous information irrelevant to the problem under scrutiny.

Saunders, Lewis & Thornhill (2007) argued in terms of what research “is not” before stating what research is. Research is not about:

- merely gathering information without a clear purpose;
- the translocation of facts from one point to another;
- collection of information without providing an interpretation of the facts;
- a cliché exploited for the purposes of an attention-seeking initiative.

Instead, research is about :

- a goal oriented activity with a clear purpose to address a business problem;
- having a defined plan to achieve certain objectives;
- disaggregating the main problem into manageable sub-problems;
- analysing a specific question based on a set of assumptions;
- a systematic compilation and interpretation of data relevant to the study;
- being a cyclical activity i.e. a hypothesis that is established and through the research study, the hypothesis is either affirmed or rejected

(Leedy & Ormrod 2005).

How may research in the business environment be defined? It may be defined as an endeavor to make an informed determination about a specific problem in systematic way (Saunders et al 2007). Business research is an organised, systematic, data-based, critical, objective, scientific inquiry into a specific business problem undertaken with the aim of increasing our understanding of and finding solutions to it (Sekaran & Bougie 2010; Leedy & Ormrod 2005).

According to Goddard & Melville (2006) formal research is an instrument whereby a purposeful study is conducted into a particular phenomenon to enhance understanding of the topic and to communicate the acquired knowledge to a wider community. Important characteristics of research are that realistic goals are set and the study is defensible, replicable, ethical and objective (Blumberg et al 2005; Leedy et al 2005). In essence, business research provides managers with the necessary basis for and facilitates informed decision-making. The information upon which the study is based may be the result of a first-hand data gathering exercise or data that is readily available within an organisation's information repository (Sekaran 2010 & Bougie). As an integral aspect of good business research practice, it is imperative to elaborate on the methods used to collect data, proffer a valid interpretation of the data collected and clarify the limitations associated with the research study (Saunders et al 2007).

3.2 Aim and Objectives of the Study

The aim of this study is to determine the impact of supplier quality management on Eskom's network operations. This study is geographically bounded to Eskom's Distribution Division's Eastern Region located in Kwazulu-Natal Province and focuses on researching the quality management practices of only those organisations that supply products and services specifically for its network operations. The survey questionnaire for dissemination to Eskom's high-value suppliers is intended to acquire quantitative data as a basis for assessing the prevalent understanding of quality management systems concepts and applicability to their respective business operations. For this reason, the quantitative study is complemented by qualitative data via a structured interview

process to establish the perceptions of Eskom's network operations personnel on supplier service and product quality. This forms the phenomenological basis of the research study.

Eskom's Eastern Region Distribution Division relies on a multitude of service and product suppliers to sustain its network operations. The suppliers range from the provision of relatively small items costing a few cents to supply contracts worth hundreds of millions of rand. The volume of products and services required for Eskom's capital expansion programmes and network operations introduces significant complexities in supply chain management processes of the organisation. Quality management of these products and services is critical to ensure the long-term sustainability of Eskom's network operations. Electricity is considered to be a strategic commodity which underpins social and economic development in the country. In view of its criticality, distribution of electricity is governed by legislation, standards and specifications. Each component used in the distribution of electricity is required to conform to a technical specification. The power network needs to comply with legislation and standards and the operation of the power network is controlled via defined procedures. Despite the vast array of legislation, standards and procedures applicable to the management of Eskom's power networks, the impact of supplier quality management is not clearly understood in relation to its power network operations. This research study aims to address this gap by contributing to the knowledge and understanding of how supplier quality management translates into enabling Eskom to manage its core strategic role in a sustainable way. Misconceptions about quality management requirements on the part of Eskom and its service providers could result in dire consequences for Eskom's customers. Typically, consequences may include power network reliability becoming compromised, increase in supply chain overhead costs, unserved energy costs and increased public safety risks due to power network failures.

The researcher investigates the conceptual understanding prevalent amongst Eskom's suppliers on quality management and interviews Eskom's operational personnel on their perceptions of quality in relation to received products and services. Eskom's network operating personnel are the end-users of products and

services received from suppliers. In effect, these employees are the “customers” of supplied products and services and are therefore best positioned to proffer an informed view of supplier’s quality management systems.

The primary objectives of this study are to:

- Understand Eskom’s supplier profile;
- Explore the understanding of Total Quality Management (TQM) amongst suppliers;
- Determine suppliers practical commitment to quality management;
- Explore suppliers methods used to achieve customer satisfaction;
- Determine the effectiveness of quality control systems and methodologies;
- Probe the effect of supplier quality management on Eskom’s Eastern Region’s power network operations.

3.3 Data Collection Strategy

A fundamental and universally accepted distinction between types of data available for research purposes is that of primary and secondary data (Saunders et al 2007; Blumberg et al 2005). Primary data refers to information that is obtained directly by a researcher on the object of the research question for the purposes of the study which could be qualitative or quantitative in nature eg. data that is gathered when individuals are interviewed or have responded to questionnaires (Neuman 2011). Secondary data refers to information that is obtained from sources that already exist eg. data that pertains to an organisation which is available and accessible to the researcher internally on existing databases or externally via internet or published records (Sekaran & Bougie 2010). The basis of this research study is primary data from implementation of a survey questionnaire amongst the population of Eskom’s suppliers and structured interviews with Eskom’s Eastern Region’s Field Services Department employees.

The data collection strategy is principally shaped by the needs and requirements of this research study. By definition of the research project, the emphasis is on studying the quality management practices of those Eskom’s suppliers specifically involved with its power network operations and understanding the impact thereof

on its power network operations in the Eastern Region. As a large national parastatal organisation, Eskom engages in commercial transactions with its myriad of suppliers for a wide range of services and products. However, not all of Eskom's suppliers are involved with provision of services and supply of products specifically for its power network operations as some suppliers are providers for non-core activities as well.

According to Neuman (2011), an often used categorisation in research studies is the quantitative versus qualitative approach. The specific research approach that is adopted may have consequences for both the research question and the outcome of the study. However, in business research the crux is not in choosing one or the other approach but the net result of the research quality design and the meticulous manner in which the study is expedited. Many business research questions may be investigated both quantitatively and qualitatively (Blumberg et al 2005). According to Lancaster (2005), there is an increasing recognition of a significant overlap between quantitative and qualitative research techniques and both approaches can make substantial contributions to the solution of specific problems. Saunders et al (2007) argued that in business or management research, a single study may use a combination of quantitative and qualitative techniques to provide greater depth to the research in what is termed a "multi-methods research design" approach.

3.3.1 Quantitative Data Collection

According to Leedy & Ormrod (2005), quantitative research involves either identification of the "observed phenomenon or exploration of the correlation of two or more phenomena". This research study focus is on a particular aspect of behavior which is quantified and counted to determine its frequency, rated for accuracy, intensity or maturity. Lancaster (2005) stated that quantitative data is considered to be more scientific, may be analysed using statistical techniques and deployed in measurable research studies where phenomena may be expressed numerically or may be classified by some numerical value. The responses from Eskom's suppliers to the questionnaire forms an important part of the primary quantitative data source for this study.

After consultation with the supervisor, the researcher instituted a four-step strategy to establish the target population for this research study. This four-step strategy is discussed in more detail in Section 3.4.1.2.1. The questionnaire was communicated to all suppliers who are identified as the target population. This technique of establishing the target population yielded a total of 82 respondents representing a cross-section of the four supplier groups. The 82 respondents constitute the sample for this study. According to Blaxter, Hughes & Tight (2006), the principal idea of sampling is that conclusions may be drawn about the entire population by the selection of a segment in a target population. The population is the ensemble of supplier group categories about which one desires to make inferences. There are several reasons for sampling viz.

- Sampling is an accepted norm in research as it helps to save costs;
- Results acquired have a reasonable level of accuracy. In Section 2.3.3, reference was made to the ideas of Deming where he advocated the use of sampling and statistical techniques as an index of quality;
- Sampling assists with more efficient and speedier recovery of data

(Neuman 2011; Goddard & Melville 2006).

According to Blumberg et al (2005) the ultimate test of a sample design is how well it represents the characteristics of the population it purports to represent. The sample must be valid and the validity depends on accuracy and precision. Accuracy is the degree to which bias is absent from the sample. Precision of an estimate is a second criterion of a good sample design. No sample fully represents its population in all respects since random fluctuations inherent in the sampling process do occur. This is called the sampling error and reflects the influences of chance on drawing the sample members (Neuman 2011; Leedy & Ormrod 2005).

3.3.2 Qualitative Data Collection

Qualitative data analysis involves acquisition of primary data via questions posed in an interview, from open-ended questions in a questionnaire or through observation (Sekaran & Bougie 2007; Blumberg et al 2005). Leedy et al (2005) argued that the term qualitative research actually encompasses several

approaches to research but are underpinned by two common factors. Firstly, there is a focus on experiences in the real world and secondly, there is a focus on studying phenomena “in all their complexity”.

According to Creswell (2007), qualitative data collection encompasses several research approaches viz. case studies, ethnography research, phenomenological studies, grounded theory studies and content studies (Finlay 2011). For this particular research project, the researcher has adopted the phenomenological approach to qualitative data acquisition. Leedy and Ormrod (2005) stated that the term phenomenology refers to a “person’s perception of an event as opposed to the event as it exists.” A phenomenological study is an attempt to develop knowledge about people’s understanding and perspectives of a particular situation (Creswell 2007). Byrne (2011) argued that phenomenology is one of several categories of qualitative research that studies the “lived experiences of humans” whereby phenomenological researchers attempt to develop an “understanding of the essential “truths” (i.e. essences) of the lived experience.” According to Smith (2011), phenomenology studies “structures of conscious experience as experienced from the first-person point of view, along with relevant conditions of experience. The central structure of an experience is its intentionality, the way it is directed through its content or meaning toward a certain object in the world.” According to Waters (2011), the primary aim of a qualitative phenomenological study is to “describe a “lived experience” of a phenomenon”.

To understand the operational impact of procured services and products, structured key supervisory and management staff from Eskom’s Eastern Region’s Field Services Department are interviewed. The researcher’s selection of this particular group of employees is based on their direct accountability for managing Eskom’s power network operations. In effect, this group of employees has “first-hand experience” of supplier product and service quality as they “live” it on a daily basis. Employees from the Field Services Department are required by Eskom’s procedures to sign-off quality and technical “Handover” documents as proof of acceptance of products and services supplied.

For both qualitative and quantitative data collection, the researcher provided each

respondent with a consent form which clearly states the aim of the research project, the name of the researcher and the voluntary nature of the respondent's participation in the project.

3.4 Research Design and Methods

This section elaborates on the purpose of the research design, the research instrument, study participants, instrument pretest, questionnaire administration and data analysis.

3.4.1 Description and Purpose

According to Blumberg et al (2005), the research design is a “blueprint” for achieving the aim and fulfillment of the research study. The multiplicity of research tools available to the researcher may be utilised to create and develop unique insights into the research project. Instead of being constrained by disciplinary bias, research studies can develop greater insight into a problem by adopting a multi-method approach (Goddard & Melville 2006; Blaxter et al 2006).

Saunders et al (2007) stated that the purpose of research is three-fold viz. exploratory, descriptive and explanatory. Research design involves the “general plan” on how the research question will be answered. The crucial aspects of the research design requires the objectives of the study to be clearly defined on the basis of an informed theoretical framework, the sources of data to be identified, the constraints that may impinge upon the research outcome to be understood, ethical considerations, the justification for the particular choice of research design and the data collection strategy including the types of data (Neuman 2011; Cresswell 2007).

In addition, research design also addresses decisions regarding the location of the study, the extent of control or influence exerted by the researcher, validity of the proposed of sampling design, measurement of the variables and the analysis of the data (Sekaran & Bougie 2010).

3.4.1.1 Construction of Instrument

The instrument for the research study is a questionnaire prepared by the researcher. The questionnaire content is based on the substantial literature survey detailed in Chapter Two on quality management concepts within an operations environment.

Prior to drafting the questionnaire, the researcher took account of several aspects to ensure the questionnaire content was comprehensive and comprehensible for the intended population. The population was a diverse supplier group i.e. some were service oriented and others supplied products. However, the questionnaire content is structured in a way that was meaningful and within the realm of each supplier's experience.

The Likert-type scale approach is used in the construction of the instrument (Likert Scale ...2006). The scale is named after its innovator - Rensis Likert – a psychologist by profession. A Likert-type scale is commonly used in questionnaires whereby respondents evaluate a statement posed to them and respond on the basis of their level of agreement or disagreement. Thus the intensity of the respondents feelings are captured by the scale. It's a method of attributing a quantitative value to qualitative data in order to facilitate statistical analysis. A numerical value is assigned to the choice of response and a mean figure for the sum total of the responses is computed at the end of the research exercise (Markusic 2011).

A Likert-item is an individual statement posed to the respondents to which they are required to respond by choosing a specific answer that best fits their opinions or views on that particular statement. The response format of a typical Likert item is:

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

(Markusic 2011)

Likert responses may be represented by bar charts, the central tendency reflected

by the median, dispersion reflected by the range across quartiles or analysed using non-parametric tests e.g. chi-square test.

When drawing up the questionnaire the researcher had to consider various factors to ensure the instrument was meaningful. Thought was given to wording, layout, order, type and form of the questionnaire (Sekaran & Bougie 2010; Saunders et al 2007). Some important factors considered in drafting the questionnaire are noted below:

- How would the respondent's identities be kept anonymous and confidential?
- Is the funnel approach used in the instrument design?
- Will the respondents feel intimidated or feel an adverse risk of being compromised by their responses?
- How easy would it be for the respondents to respond to the research survey?
- Is the requirement for participation clearly and explicitly explained to the participants?
- Is the layout of the questionnaire complicated and confusing?
- Are the statements succinct but sufficiently detailed?
- Is the language used simple, clear and unambiguous?
- Is there a prevalence of unintended assumptions language used?
- Does the language used guide the respondents to a specific or preferred response?
- Will there be consistency in the responses received?

(Blumberg et al 2005; Leedy & Ormrod 2005).

In administering the questionnaire, consideration was given to the following:

- Was the timing within the business cycle appropriate for administering the questionnaire?
- On receipt of the questionnaire, will the respondents be favourably disposed to replying?
- Will the respondents be sufficiently motivated to respond to the research survey?

- How easy would it be for the respondents to email their responses?
- Is there an indication that the research project results will be shared with the respondents?
- Is there a follow-up strategy in place to encourage suppliers to respond in cases where responses were not forthcoming?

(Blumberg et al 2005; Leedy & Ormrod 2005).

The questionnaire is divided into six sections. The first section contains general administrative-type questions about supplier category and ISO compliance or accreditation. The next five sections deal with key concepts from literature survey such as TQM, level of commitment to quality management systems, customer satisfaction, implementation of quality controls and impact of quality on Eskom's operations.

3.4.1.2 Recruitment of Study Participants

The researcher adopts a two-pronged approach to recruit participants in accordance with the multi-method ethos of this research study. The target population for quantitative data comprises Eskom's Eastern Region's suppliers. The second group of participants is comprised of Eskom's employees with whom structured interviews are conducted to acquire qualitative data.

3.4.1.2.1 Recruitment of Participants for Quantitative Data

From the focus area of this research study, the first step was for the researcher to exclude consideration of suppliers whose business operations do not impact upon Eskom's power network operations.

Once this distinction is established, the second step was to systematically identify supplier groups which have a direct or indirect bearing on Eskom's power network operations. Here several supplier groups were identified as the research study's focus group. The first group comprises of product manufacturers whose products are technically approved for use on Eskom's power networks. This group typically is comprised of manufacturers who supply Eskom with items such as cables, conductors, meters, transformers and insulators amongst other items. The second

group of suppliers is comprised of product re-distributors and wholesalers. The third group comprises of suppliers that are powerline construction companies contracted by Eskom to build new networks and to assist with specific maintenance activities. Eskom's Eastern Region's annual capital expansion budget is in the order of R1.4 billion and a significant proportion of this budget is allocated to powerline contractors. The fourth group is comprised of electrical engineering consulting companies who are involved with design, project management and commissioning of newly constructed networks. The four groups identified for this research study are based on the researcher's intimate knowledge of supplier groups involved in Eskom's Eastern Region's power network operations.

On establishing the target group for this research study, the third step is to identify the individual suppliers who constitute the entire population of suppliers involved with Eskom's power network operations. With the consent of Eskom's Regional Procurement and Commercial Managers, the researcher interrogated the SAP database to seek out the supplier groups which are of interest to this research study. The SAP database system architecture does not enable information on the target group to be easily extracted and the raw supplier data required considerable manipulation to select the required information. The list of relevant suppliers was identified through a tedious manual verification process. Thereafter, the appropriate personnel in each supplier organisation, who could meaningfully add value to this research project was contacted to respond to the questionnaire.

The fourth step was to refine the target population by means of applying two filters. The first filter applied was the time period for which the suppliers were active in supplying products and services to Eskom. Eskom's financial year commences from 1 April till 31 March of each year. This research study is limited to suppliers who had registered transactions and were actively engaged in work with Eskom's Eastern Region for the past two financial years viz. the period 1 April 2009 to 31 March 2010 and the period from 1 April 2010 to 31 March 2011. The researcher deemed it prudent for reasons of relevance and validity to include only those suppliers who actively engaged in commercial transactions with Eskom over the past two financial years. The second filter applied to the target population was to

concentrate this research study on the top seventy percent of suppliers in terms of transaction value. The principal motivation for limiting the target population to the top 70% rand-value suppliers is two-fold: firstly, the aggregated impact of smaller suppliers on power network operations is considered to be negligible and secondly, it is the researcher's considered view that including a large number of smaller suppliers will not add appreciable or ground-breaking value to achievement of the research aim.

3.4.1.2.2 Recruitment of Participants for Qualitative Data

Eskom's Eastern Region, which corresponds to the boundaries of KwaZulu-Natal Province, is divided into four distinct operating areas known as Field Service Areas (FSA's). Each FSA is comprised of a number of Technical Service Centres (TSC's) which are run by Senior Supervisors and Works Coordinators. The Senior Supervisors and Works Co-ordinators report directly to the respective Field Services Centre Managers for each of the four FSA's respectively. Due to the dispersion of Field Services staff throughout KwaZulu-Natal province, it was not practical for the researcher to conduct face-to-face interviews. Instead, the researcher contacted each of the staff members telephonically and presented the structured interview questions via email. Field Services Department employees are required to respond to questions about their views on supplier quality management on the basis of a specific range of answers. In total, off the 53 Field Services supervisory staff were contacted to participate in the structured interview process, a combination of 41 Senior Supervisors, Works Coordinators and Field Services Managers responded positively to the questionnaire. There were 20 employees who could not be contacted either due to them being on long leave or away from office.

3.4.2 Pretest and Validation

According to Saunders et al (2007), a pretest is a small scale endeavour to test a questionnaire with the aim of minimising difficulties for respondents, signify problems with data recording and to serve as a yardstick of data reliability. Leedy & Ormrod (2005) argued that a pilot test is an "excellent way" to determine whether or not a study is feasible. According to Lancaster (2005), applying a

pretest is “extremely useful” in adapting the research instrument to be more effective in the collection of data. A pretest is an index of a research instrument’s efficacy. It is a small test undertaken at the outset of the research project that may alert the researcher to larger possible problems or significant pitfalls in deploying the research instrument. It also obviates potential ambiguities and areas of uncertainty in the project.

Prior to the dissemination of the research instrument, the researcher conducted a pretest. Based on the response of the pretest and in discussion with the pretest participants, the research instrument was modified, refined and accuracy improved. In addition, the pretest proved that the variables that were intended to be measured were valid. Before the pretest was instituted, the research instrument contained some degree of overlap between questions that may have been confusing to respondents. This was not evident to the researcher prior to the pretest.

3.4.3 Administration of Questionnaire

For the quantitative data exercise, the participants for the study were recruited as indicated in the four-step strategy detailed in Section 3.4.1. Suppliers in each of the four categories – product manufacturers, distributors, consulting engineers and powerline contractors – were contacted via email. The email request contained a brief overview of the research project, a set of requirements for participation, a time-line was stipulated for a response and statement on the voluntary participation of suppliers in the study. There were two attachments to the email. The first attachment was an “Informed Consent Letter” which highlighted the ethical dimensions of the research project and the second attachment was an Excel-based spreadsheet containing the questionnaire. The participants were requested to respond to the questions posed in the questionnaire and return the completed questionnaires together with a copy of the signed informed consent letter either via email or fax. The response of each participant was collated into an electronic archive. An Excel-based master spreadsheet was developed wherein the individual responses to the questions were recorded for the purposes of summation and quantification. The quantified results were subjected to analysis

using SPSS software.

The researcher took cognisance of the possibility of response bias in a self-completion questionnaire. In a face-to-face interview-type questionnaire administration, response bias could be significantly attenuated. However, consideration was given to this factor in the design of the instrument to ensure the content could be related to the daily operational activities of the respondents. The researcher is confident that the methodology adopted provided the best opportunity for obtaining the required response rate.

For purposes of the phenomenological study, qualitative data was acquired via the structured interview process. Eskom employees identified for participation – as detailed in Section 3.4.1.2.2 – were contacted telephonically and apprised of the research project objectives. The Eskom employees, who were target population for the structured interview questions, are dispersed throughout Kwazulu-Natal Province. Due to time-constraints and for logistical reasons, the researcher did not consider it feasible to conduct face-to-face interviews with each staff member. Instead, the approach adopted was telephonic contact and via a structured interview process where questions were emailed to the employees and were required to select their responses based on a list of possible answers. In a similar vein to the administration of questionnaires to the suppliers discussed previously, the responses of each Eskom employee was consolidated onto a master Excel-based spreadsheet for further analysis.

3.5 Data Analysis

The data for this research study is analysed by use of statistical techniques. According to Leedy et al (2005) statistics play an important role in research in two ways. Firstly, descriptive statistics are used to inform the researcher about data characteristics such as the midpoint of the data, the spread of the data and level of correlation within the data set. Secondly, inferential statistics are used to inform the researcher about the behavior of a larger population by analysing the behavior of a smaller sample from that population (Keller 2006; Lind, Machal & Wathen 2005).

For this research study, data analysis was performed with SPSS version 18 (SPSS Inc., Chicago, Illinois). Statistical significance is set at alpha equal to 0.05. Non-parametric tests were performed to assess the data (if all answers to a question had the same probability) – one-sample chi-square test or one-sample binomial test were used where appropriate.

Associations between two categorical variables were tested using the Chi-square test and reported the statistical significance of the Pearson test or Fischer's Exact test where more appropriate. Due to the categorical nature of the data counts and percentages in the tables are presented. Bar charts are also displayed with corresponding counts for each Likert scale variable/question.

Bar charts displaying Likert scale questions show the median response per question as a measure of location.

3.6 Summary

Business research is primarily used for decision making and a research method is an instrument used to provide indepth understanding of a particular business phenomenon or problem area. Information quality is crucial for businesses to ensure correct decisions are made in the management of large complex operations. Research is not about merely gathering information, facts and figures without a clear purpose. Research has a clear objective, defined plan and is goal oriented.

The aim of this research study is to determine the impact of supplier quality management on Eskom's network operations. The aim of the study shaped and informed the research method deployed. The research method involved using quantitative and qualitative data via administered questionnaires for Eskom's suppliers and structured interviews with Eskom's network operations staff. The data recovered from these research instruments formed the essence of the primary data needed for the study.

The research methodology is based on a multi-methods approach. In modern business operations, there is growing acknowledgement that convergence of quantitative and qualitative data can contribute to a substantial understanding of a business research problem. Whilst a questionnaire may be useful for deriving quantitative data, the richness of research data is complemented by interviews to provide greater depth to the research question. Qualitative data compiled for this research project is the basis for the phenomenological dimension of the study. A phenomenological study is used to probe understanding and perspectives of a particular situation in terms of people's perception of a particular phenomenon as opposed to what it really is.

The research design serves the purpose of being a blueprint for achieving the aim of the study. The research instrument is the questionnaire and is based on the Likert scale. This scale is commonly used in questionnaires whereby respondents evaluate a statement posed to them and respond on the basis of their level of agreement or disagreement. Recruitment of study participants for the quantitative data was based on the population of Eskom's suppliers whereas participants for the qualitative dimension were sourced from among Eskom's network operations personnel.

Data for this research study was compiled and analysed using SPSS software. The results of the data compilation are discussed in Chapter 4.

CHAPTER 4

PRESENTATION OF RESULTS

4.1 Introduction

In the previous chapter, attention was given to the research methodology adopted for this study. The multi-methods data collection approach to be used for this study was considered to be the most appropriate strategy to achieve the aim and objectives of the study. Data gathered for this study is presented in this chapter.

Quantitative data for this research study forms the bedrock of the analysis. A total of 82 suppliers of products and services to Eskom Eastern Region responded to the research survey questionnaire. The responses from each supplier are consolidated in tables. These responses afford insight into the understanding of how supplier quality management impacts upon Eskom's operations. Quantitative data is considered more scientific, lends itself to statistical analysis and phenomena may be expressed numerically (Lancaster 2005).

As an integral element of the multi-methods approach of this study, qualitative data acquired was based on structured interviews conducted with 41 of Eskom's Eastern Region field supervisory and management staff. For an in-depth understanding of the operational impact of procured services and products, the researcher chose this particular group of employees of Eskom as they are directly accountable for managing Eskom's power network operations and are end-users of supplier's products and services. These employees are directly impacted upon by suppliers' products and services in discharging their daily tasks and are therefore ideally positioned to provide first-hand accounts of the quality thereof. A phenomenological study is a type of qualitative data collection and describes the "lived experience" of a phenomenon (Byrne 2011; Waters 2011).

The results of the quantitative data collection are tabulated and qualitative data is discussed in this chapter.

4.2 Overview of Eskom's Eastern Region's Suppliers and Operational Staff

Eskom's SAP system was used to identify all suppliers with whom Eskom Eastern Region transacted with over the past two financial years (April 2009 to March 2010 and April 2010 to March 2011). The SAP database yielded a list of 839 suppliers who were remunerated for either services rendered or products supplied to Eskom's Eastern Region. The list of 839 suppliers provided a variety of products and services including those required for its network operations. Over the past two financial years, the summated value of transactions between Eskom's Eastern Region and its suppliers was approximately R3.9 billion. For the purposes of this study, however, the researcher was primarily interested in those suppliers who were involved with provision of products and services specifically for Eskom's Eastern Region's network operations.

The complete supplier list was filtered for companies that are power network product manufacturers, suppliers, distributors, engineering consulting companies and power network construction contractors relevant to this research study. A further filter applied was to include those suppliers whose transaction value was over R500 000. Applying these two criteria, the supplier list yielded a total of 187 suppliers and accounted for R2.83 billion of transaction value or 72% of the total transaction value between Eskom Eastern Region and its suppliers. The information on the list of suppliers obtained from SAP was also supplemented by information contained in Eskom's Eastern Region's supplier database and Eskom's list of accredited suppliers. This approach was used to determine the total population of suppliers for the study. A total of 82 responses were received which served as the study sample. The transaction value of 72% represented most of the largest suppliers and the researcher is confident the designated supplier population validates the study.

For the phenomenological dimension of the study, structured interviews were conducted with 41 of Eskom Eastern Region's network operations management and supervisory staff. This group of employees comprised of staff from Eskom's Field Services Department. The Eskom staff included managers, engineers, senior supervisors and works co-ordinators specifically chosen as they are charged with

the responsibility of operating and maintaining Eskom's networks. These employees also play a critical role in the commissioning of newly constructed power networks and managing the network operations during forced outages. The work of Field Services Department employees is directly impacted by supplier products and services which places these employees in an optimal position to proffer comment on supplier's quality management. Of the 62 employees who form the total number of employees in this category of personnel, 41 employees participated in structured interviews. This research study is based on quantitative and qualitative data collected from 123 participants.

4.3 Data Presentation

According to Leedy & Ormrod (2005), research data may be presented in a logical manner using several steps. Firstly, the section of the research report dealing with data presentation should be introduced with an overview of how the research results are structured. Secondly, data from the research study should be presented "in terms of the problem" i.e. after gathering the mass of data, it should be re-structured and aligned in a way that corresponds to the particular objectives of the problem being studied. Thirdly, it is important to maintain a methodological sequence in presenting the data so that the reader is able to comprehend the argument being developed and the core issues being addressed by the study. Fourthly, data should be organised into tables, figures and graphs for ease of understanding and interpretation.

Blumberg et al (2005) stated that data presentation should include results from statistical tests and technical information gained from the data collection effort. For ease of analysis and in order to develop conclusions relating to the research objectives, the data is required to be summated and grouped thematically. In respect of statistical techniques deployed, the rationale for using the particular technique should be explained (Leedy & Ormrod 2005).

In this chapter the quantitative data, collected from the questionnaire recovered from 82 Eskom's suppliers, is presented first. The data has been summarised for each question, grouped into each of the research objectives and presented as

frequencies and percentages. Data presentation is done in the form of tables and graphs. Qualitative data, based on structured interviews with 41 Eskom Field Services employees, acquired as part of the phenomenological dimension of the study is presented in the form of discussion thematically coincident with the research study's objectives. The quantitative data was initially recorded on Excel spread sheets and thereafter imported into SPSS for detailed analysis.

4.4 Research Objectives

As indicated in Chapter 1, this research study had six primary objectives in relation to understanding the impact of supplier quality management. These are:

1. To ascertain the understanding of total quality management amongst Eskom's suppliers.
2. To probe suppliers commitment to quality management of products and services provided to Eskom.
3. To determine suppliers commitment to customer satisfaction in the provision of products and services to Eskom.
4. To determine the effectiveness of quality controls implemented by Eskom's suppliers.
5. To determine the impact suppliers quality management practices on Eskom's operations.
6. To understand the perceptions of Eskom's Field Services Department employees on the effectiveness of supplier quality management on network operations.

The research objectives, together with the questions contained within the questionnaire and structured interviews, were based on key quality management concepts identified in the literature survey.

The first objective was to ascertain the understanding of total quality management concepts by Eskom's suppliers. This was achieved by exploring whether suppliers have officially documented quality policies, supplier employees knowledge of quality management, link between quality and productivity and optimisation of quality costs with those of internal/external failure.

The second objective was to determine supplier's commitment to quality management in the provision of products and services to Eskom. For this objective, the supplier visibility in respect of interaction with Eskom, continuous improvement philosophies, supplier's staff competency and achievement of quality objectives for products and services were interrogated.

The third objective was to develop an understanding of supplier's commitment to ensuring customer satisfaction in providing products and services to Eskom. The main elements under consideration for this objective were supplier's business ethos in terms of quality as the main aim of their operations, communication with Eskom about product and service quality, feedback solicited from Eskom on quality compliance and review of products and service quality levels.

The fourth objective was to ascertain the effectiveness of quality controls established by Eskom's suppliers. The level of conformance to specifications, management of non-conformances, timeous remedy of non-conformances and quality defect identification systems were interrogated.

The fifth objective was to understand the impact of supplier quality management on Eskom's network operations. The key dimensions of this objective were to ascertain supplier's views of product and service quality impact on Eskom's power network reliability, maintenance, performance and safety.

The sixth objective was to solicit the views of Eskom's Field Services employees on their experience of supplier's quality management effectiveness in relation to network operations. This objective was based on the phenomenological aspect of this study where Eskom employees were interviewed.

Each research objective for suppliers and Eskom's employees was sub-divided into several questions which formed the basis for discussion around particular quality management concepts. The survey questionnaire and structured interview questionnaire are presented in Appendix B and C.

4.5 Quantitative Analysis

A questionnaire was designed as the main instrument for gathering quantitative data required for this study. The response from each supplier was recorded in Excel spread sheets, categorised according to research objectives and imported into SPSS version 18. In statistical terms, the data set is comprised of categorical data as opposed to continuous data. It therefore follows that the data analysis is reliant on frequencies, percentages and inferential statistics i.e. use of chi square test. Cronbach's alpha regression analysis was used as a measure to test the richness of the data contained within the quantitative data. The Tables and Figures below reflect the SPSS outputs.

On account of the categorical nature of the data, counts and percentages are presented in the tables. Bar charts are also displayed with corresponding counts for each Likert scale variable/question. Bar charts displaying Likert scale questions show the median response per question as a measure of location (Keller 2006).

4.5.1 Data Reliability Testing – Cronbach's Alpha Coefficient

Bryman & Cramer (2006) stated that reliability of data is a measure of its consistency. Cronbach's Alpha is one of the most commonly and popularly used measures of reliability where internal consistency of data or correlation of items in a survey instrument is assessed for its reliability (Allen 2005; Santos 1999). According to Gliem & Gliem (2003), it is imperative to use Cronbach's Alpha Coefficient whenever a Likert-type scale is used for a research instrument in quantitative data analysis. Bruin (2006) stated that Cronbach's Alpha "is a measure of internal consistency, that is, how closely related a set of items are as a group". If a variable which is generated from a set of questions returns a stable response, then the variable is considered to be reliable (Santos 1999).

Gliem & Gliem (2003) stated that Cronbach's Alpha reliability coefficient normally ranges between 0 and 1 but there is no lower limit to the coefficient. The closer Cronbach's alpha coefficient is to 1.0 the greater the internal consistency of the items in the scale (Bryman & Cramer 2006; Bruin 2006; Allen 2005). According to George & Mallery (2003) there are generally accepted norms amongst

professionals to determine the reliability of data where, if, alpha is:

- > 0.9, data reliability is Excellent;
- > 0.8, data reliability is Good;
- > 0.7, data reliability is Acceptable;
- > 0.6, data reliability is Questionable;
- > 0.5, data reliability is Poor;
- < .5, data is reliability Unacceptable

The majority view considers an alpha of 0.8 as a good index data reliability, although, in some literature, a value of 0.7 is also considered acceptable (Bryman & Cramer 2006; Bruin 2006; Allen 2005; Gliem & Gliem 2003).

Cronbach's Alpha Test was applied to the quantitative data gathered for this study. The non-Likert section of the questionnaire (first three questions) was excluded from the test. In Table 1, the Cronbach Alpha Coefficient Test returned a score of 0.866.

Table 1: Cronbach's Alpha Test

Cronbach's Alpha	Number of Items
0.866	25

The result in Table 1 indicated that in terms of the argument of George & Mallery (2003) the quantitative data gathered for this research study has a high index of reliability as it is above the "acceptable" threshold of 0.7. The data is inherently consistent and may be used for further analysis.

4.5.2 Overview of Supplier Profile

Eskom's suppliers who have a direct bearing on its power network operations are electrical contractors, product manufacturers, engineering consulting companies and electrical hardware distributors. At the outset, the researcher considered it important to provide an overview of the profile of the supplier organisations that participated in this study. Table 1 presents background data on Eskom's suppliers. Off the 82 supplier responses received, 58% were electrical contractors, 20% were product manufacturers, 17% were engineering consulting companies and 5% were

electrical hardware distributors. In terms of ISO 9000 accreditation, a significant majority (76%) of the suppliers were not accredited whilst only 24% were accredited. The responses indicated that 52% of the suppliers are engaged in a business relationship with Eskom for over 10 years, 25% of the suppliers for between 5 and 10 years and 23% for less than 5 years.

Table 2: Supplier profile, ISO accreditation and length of time

Supplier Profile		Freq	Percent	p value
What is the nature of your business operation?	Product manufacturer	16	20%	< 0.001
	Engineering consulting company	14	17%	
	Electrical contracting and construction company	48	58%	
	Electrical hardware distributor	4	5%	
	Other	0	0%	
	Total	82	100%	
Is your company accredited in accordance with ISO 9000 standards?	Yes	20	24%	< 0.001
	No	62	76%	
	Total	82	100%	
For what length of time has your company been providing products and/or services to Eskom?	0-5yrs	20	25%	0.001
	6-10yrs	19	23%	
	Over 10yrs	43	52%	
	Total	82	100%	

In Table 2, none of the variables (responses to the questions) have equal probability. The statistical significance is set at alpha equal to 0.05 and when applying the chi square and binomial tests, the p-value of 0.001 indicates the data is not evenly distributed across the possible given categories per question/variable. Also, these p-values illustrate that the categories for each question are not similar in proportion, for instance, it is shown that there is a significantly bigger group of Eskom contractors that are not ISO 9000 accredited.

4.5.3 Objective One: To ascertain understanding of total quality management amongst Eskom's suppliers

This objective was to gauge the level of understanding that prevails amongst

Eskom's suppliers on total quality management as a concept. It is observed that most (above 80%) of the responses are affirmative when 'Agree' and 'Strongly agree' are combined for all but the last question which is almost 50% affirmative. All questions pertaining to the mentioned objective are shown in Table 3.

Table 3: Objective One – Understanding of Total Quality Management

Understanding of Quality Management		Freq	Percentage
B1 It's important for my company to have an officially documented quality management system policy.	Strongly disagree	0	0%
	Disagree	1	1%
	Neutral	3	4%
	Agree	26	32%
	Strongly agree	52	63%
	Total	82	100%
B2 All my company's staff are knowledgeable about the quality management objectives set for products and/or services we provide.	Strongly disagree	1	1%
	Disagree	2	2%
	Neutral	5	7%
	Agree	37	45%
	Strongly agree	37	45%
	Total	82	100.0%
B3 In our company we have fully optimised the cost of providing quality effort with costs of internal / external failure.	Strongly disagree	0	0%
	Disagree	1	1%
	Neutral	16	20%
	Agree	38	46%
	Strongly agree	27	33%
	Total	82	100.0%
B4 Implementation of a Total Quality Management (TQM) system improves productivity and efficiency within my company.	Strongly disagree	0	0%
	Disagree	0	0%
	Neutral	5	6%
	Agree	33	40%
	Strongly agree	44	54%
	Total	82	100.0%
B5 My company experiences occasional problems with quality management of products and/or services we provide.	Strongly disagree	4	5%
	Disagree	16	20%
	Neutral	19	23%
	Agree	41	50%
	Strongly agree	2	2%
	Total	82	100.0%

The bar chart, Figure 4.1, compares the median response per question. The Likert scale is as follow: 1=' Strongly disagree', 2='Disagree', 3=' Neutral', 4=' Agree' and 5=' Strongly agree'.

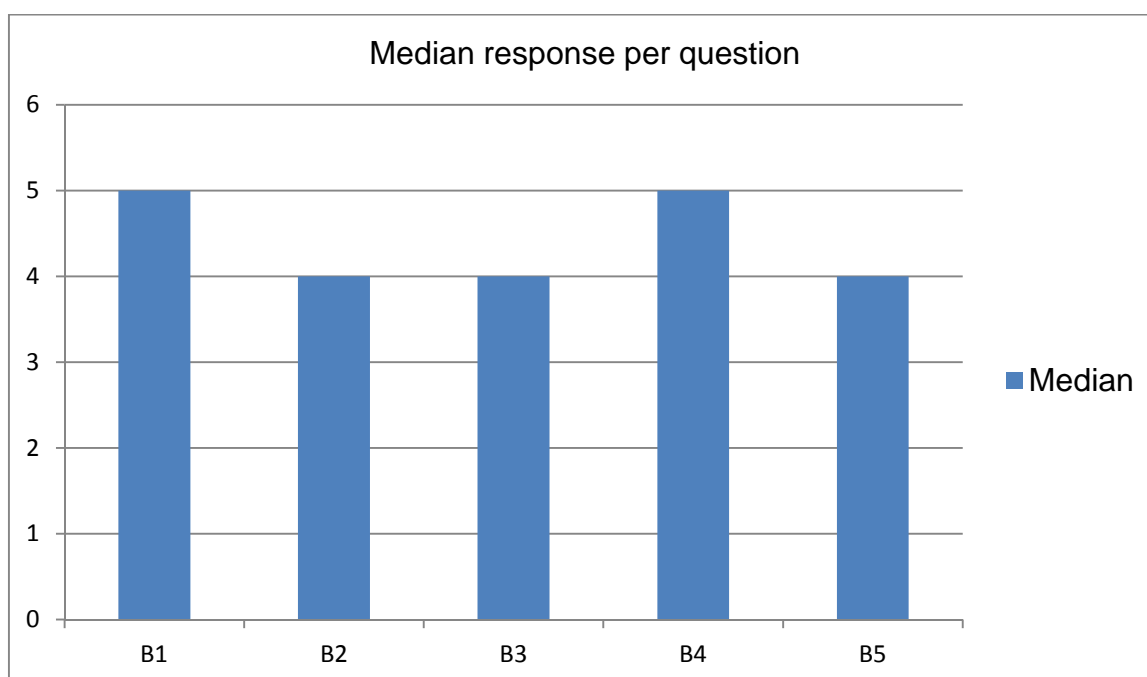


Figure 4.1 Comparison of the median response per question for Objective One

The labels B1, B2, B3, B4 and B5 in Figure 4.1 correspond with numbering sequence for each question in Table 2. It is observed that the median is skewed towards “Agree” and “Strongly Agree” responses. The median score is the centre value (when ordering the data from small to large) and thus indicates that at least 50% of the data is above or equal to this (median) score, meaning that at least half of the respondents responded affirmative to a specific question.

4.5.4 Objective Two: To determine suppliers’ commitment to quality management of products and services

This objective was designed to probe suppliers on their commitment to ensuring their products and services supplied to Eskom meet the expected quality requirements. Documented quality policies, supplier visibility in providing support to Eskom, establishment of quality criteria for products and services, competence of suppliers’ employees and continuous improvement strategies are critical to assess supplier commitment. It is observed that most (above 90%) of the responses are affirmative when ‘Agree’ and ‘Strongly agree’ are combined for all questions.

All questions pertaining to the mentioned objective are shown in Table 4.

Table 4: Objective Two – Suppliers’ commitment to product and service quality

Supplier Commitment to QM		Freq	Percent
C1 My company's Top Management is practically and visibly committed to meeting Eskom's technical quality requirements.	Strongly disagree	0	0%
	Disagree	0	0%
	Neutral	1	1%
	Agree	14	17%
	Strongly agree	67	82%
	Total	82	100%
C2 My company has comprehensively implemented effective continual improvement strategies for products and services supplied to Eskom.	Strongly disagree	0	0%
	Disagree	0	0%
	Neutral	1	1%
	Agree	37	45%
	Strongly agree	44	54%
	Total	82	100%
C3 My company has clearly defined quality management policies relevant to all products and/or services provided to Eskom.	Strongly disagree	0	0%
	Disagree	1	1%
	Neutral	4	5%
	Agree	40	49%
	Strongly agree	37	45%
	Total	82	100%
C4 Our staff are skilled, trained, competent and capable of meeting specified quality requirements.	Strongly disagree	0	0%
	Disagree	0	0%
	Neutral	3	4%
	Agree	37	45%
	Strongly agree	42	51%
	Total	82	100%
C5 Our company consistently reviews whether our products and/or services are achieving quality objectives.	Strongly disagree	0	0%
	Disagree	0	0%
	Neutral	4	5%
	Agree	40	49%
	Strongly agree	38	46%
	Total	82	100%

The bar chart, Figure 4.2, compares the median response per question. The Likert scale is as follow: 1=’ Strongly disagree’, 2=’Disagree’, 3=’ Neutral’, 4=’ Agree’ and 5=’ Strongly agree’.

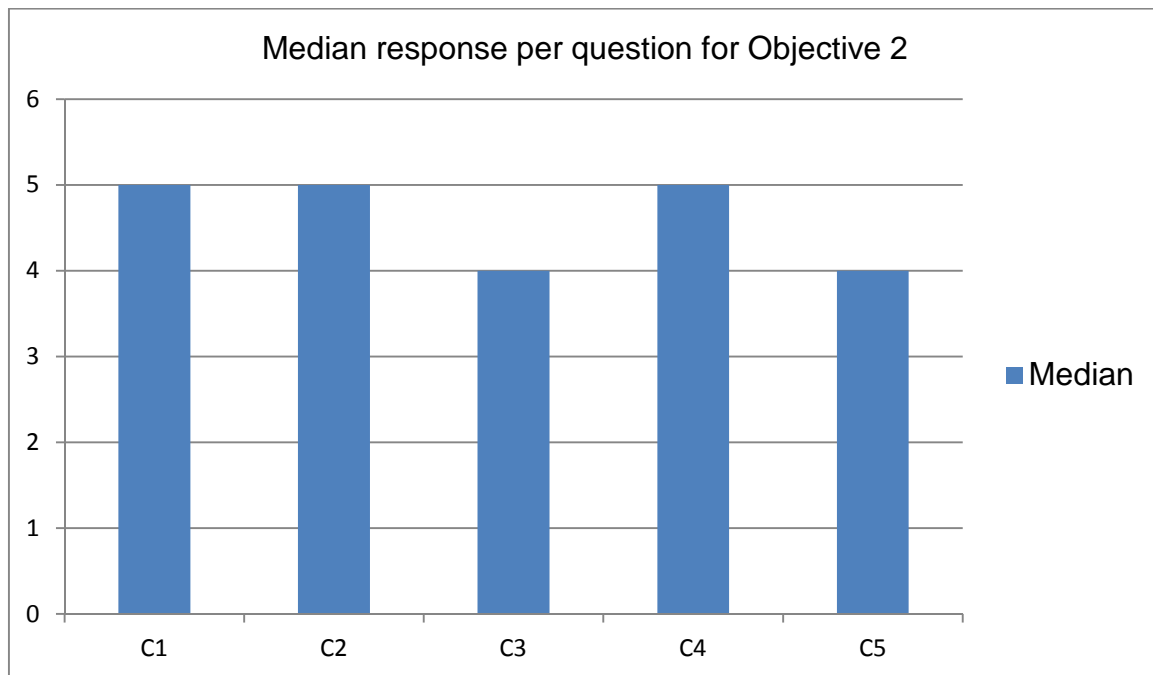


Figure 4.2 Comparison of the median response per question for Objective Two

The labels C1, C2, C3, C4 and C5 in Figure 4.2 correspond with numbering sequence for each question in Table 3. It is observed that the median is skewed towards “Agree” and “Strongly Agree” responses. The median score is the centre value (when ordering the data from small to large) and thus indicates that at least 50% of the data is above or equal to this (median) score, meaning that at least half of the respondents responded affirmatively to a specific question.

4.5.5 Objective Three: To determine suppliers’ customer focus and commitment to customer satisfaction

This objective was intended to develop an understanding of suppliers’ commitment to customer satisfaction. The main aspects considered for this objective were customer satisfaction as the principal objective, effective communication about product and service quality to customer, system to verify customer requirements, customer feedback mechanism and verification of meeting customer requirements. It is observed that most (above 90%) of the responses are affirmative when ‘Agree’ and ‘Strongly agree’ are combined for all questions. Only the question “Our

company always obtains feedback from Eskom regarding our product and/or service quality” have an affirmative response less than 90% (‘Agree’ and ‘Strongly agree’ combined = 69.5%). All questions and responses are shown in Table 5.

Table 5: Objective Three – Suppliers’ commitment to customer satisfaction

Supplier Commitment to Customer Satisfaction		Freq	Percent
D1 Our company attains customer satisfaction because it's the main aim of our business.	Strongly disagree	0	0%
	Disagree	0	0%
	Neutral	4	5%
	Agree	26	32%
	Strongly agree	52	63%
	Total	82	100%
D2 Our company always communicates effectively with Eskom about the quality of products or services supplied.	Strongly disagree	0	0%
	Disagree	0	0%
	Neutral	3	3%
	Agree	40	49%
	Strongly agree	39	48%
	Total	82	100%
D3 Our company has an effective system in place to confirm Eskom's requirements where Eskom provides no documented statement of requirements.	Strongly disagree	0	0%
	Disagree	2	2%
	Neutral	10	12%
	Agree	39	48%
	Strongly agree	31	38%
	Total	82	100%
D4 Our company always obtains feedback from Eskom regarding our product and/or service quality.	Strongly disagree	3	4%
	Disagree	6	7%
	Neutral	16	20%
	Agree	38	46%
	Strongly agree	19	23%
	Total	82	100%
D5 Our company is always able to determine whether Eskom's requirements are met as specified.	Strongly disagree	0	0%
	Disagree	2	2%
	Neutral	5	6%
	Agree	41	50%
	Strongly agree	34	42%
	Total	82	100%

The bar chart, Figure 4.3, compares the median response per question. The Likert scale is as follow: 1=‘ Strongly disagree’, 2=‘Disagree’, 3=‘ Neutral’, 4=‘ Agree’ and 5=‘ Strongly agree’.

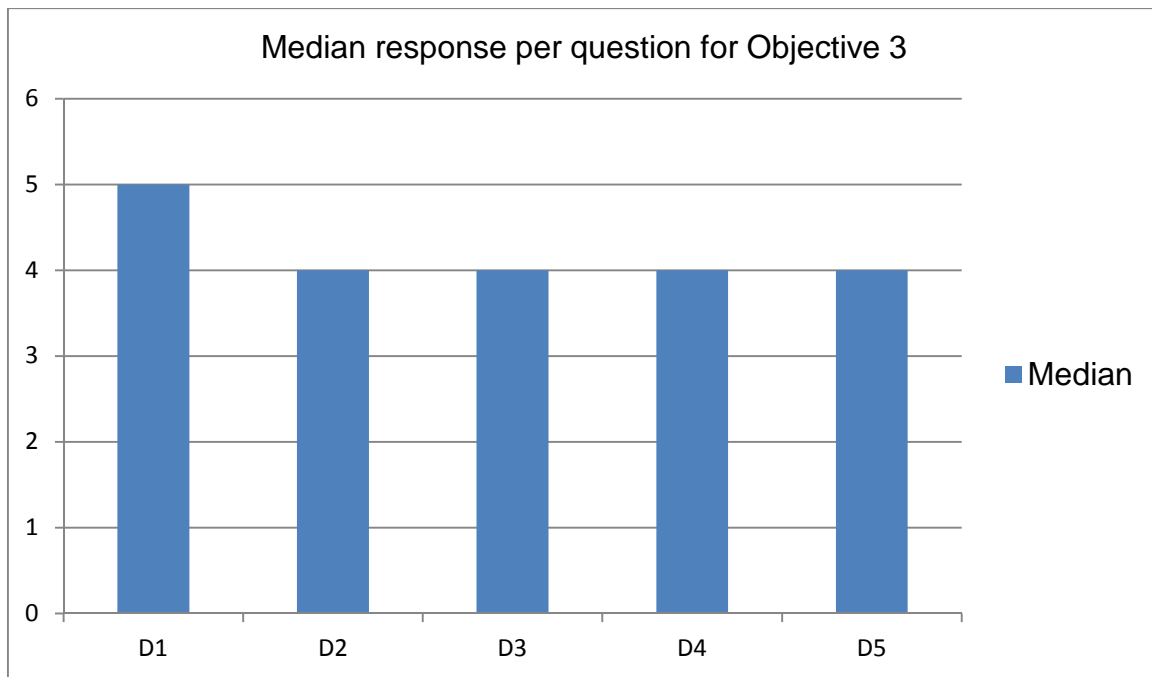


Figure 4.3 Comparison of the median response per question for Objective Three

The labels D1, D2, D3, D4 and D5 in Figure 4.3 correspond with numbering sequence for each question in Table 4. It is observed that the median is skewed towards “Agree” and “Strongly Agree” responses. The median score is the centre value (when ordering the data from small to large) and thus indicates that at least 50% of the data is above or equal to this (median) score, meaning that at least half of the respondents responded affirmatively to a specific question.

4.5.6 Objective Four: To determine the effectiveness of suppliers quality control measures in the provision of products and services to Eskom

This objective was to determine the effectiveness of quality control measures exercised by suppliers in their operations. Important principles of quality control that were used were the need for quality control improvements, systems to prevent defects from proliferating, compliance to customer specifications, remedies for non-conformances and minimising repetitive non-conformances. In Table 6, in response to Question E1 “Our company's quality control measures don't require any improvement”, most (53.6%) of respondents confirmed that their quality control measures require improvement, almost a third (31.7%) are unsure if their quality control measures are appropriate or not and only 14.7% are convinced that

they have sufficient quality control measures in place. The responses on the remaining questions are above 75% affirmative when combining 'Agree' and 'Strongly agree'. All questions pertaining to the mentioned objective are shown in Table 6.

Table 6: Objective Four – Supplier quality control measures

Supplier QM Controls		Freq	Percent
E1 Our company's quality control measures don't require any improvement.	Strongly disagree	11	13%
	Disagree	33	40%
	Neutral	26	32%
	Agree	9	11%
	Strongly agree	3	4%
	Total	82	100%
E2 Our quality control system ensures defects/defective products are never installed on Eskom networks.	Strongly disagree	0	0%
	Disagree	4	5%
	Neutral	9	11%
	Agree	37	45%
	Strongly agree	32	39%
	Total	82	100%
E3 Our products and/or services supplied to Eskom conform to ALL Eskom's standards and specifications.	Strongly disagree	0	0%
	Disagree	1	1%
	Neutral	1	1%
	Agree	34	42%
	Strongly agree	46	56%
	Total	82	100%
E4 Eskom is satisfied with the consistency and timeousness of our rectifying non-conformances (NC's) related to our products / services.	Strongly disagree	0	0%
	Disagree	1	1%
	Neutral	17	21%
	Agree	43	52%
	Strongly agree	21	26%
	Total	82	100%
E5 Our company's NC controls ensures defects related to our products and/or services are never repeated on Eskom networks.	Strongly disagree	0	0%
	Disagree	1	1%
	Neutral	10	13%
	Agree	43	52%
	Strongly agree	28	34%
	Total	82	100%

The bar chart, Figure 4.5, compares the median response per question. The Likert scale is as follow: 1=' Strongly disagree', 2='Disagree', 3=' Neutral', 4=' Agree' and

5= 'Strongly agree'.

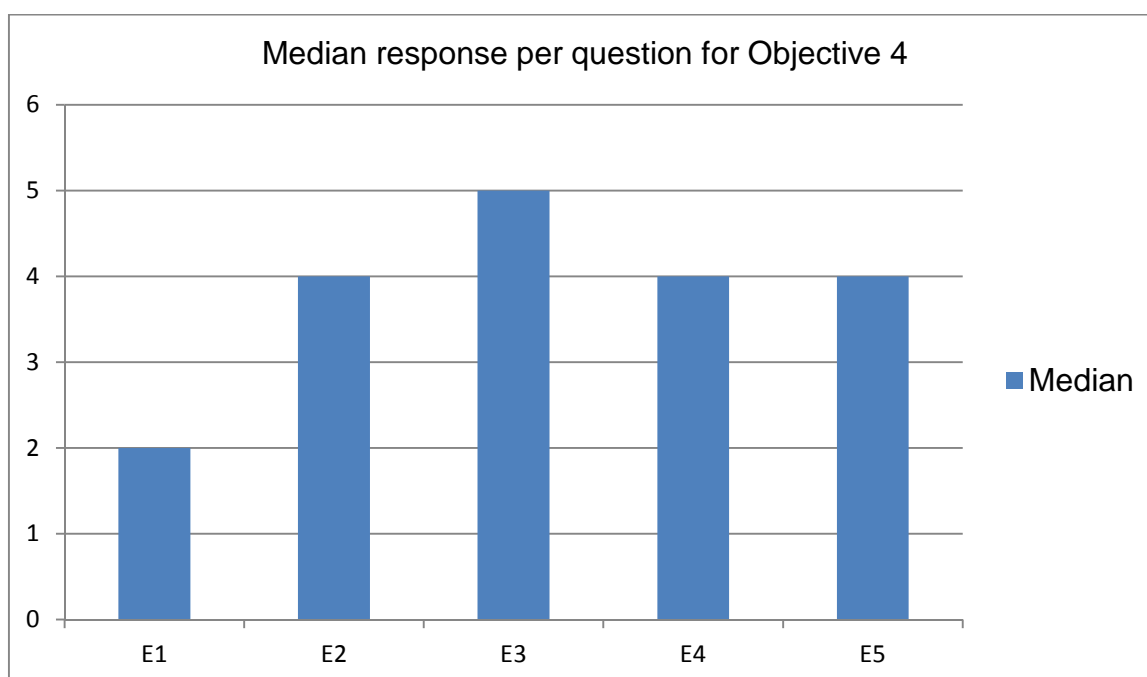


Figure 4.4 Comparison of the median response per question for Objective Four

The labels E1, E2, E3, E4 and E5 in Figure 4.4 correspond with numbering sequence for each question in Table 5. It is observed that the median for each question is spread across each of the possible response categories. The median score is the centre value (when ordering the data from small to large) and thus indicates that at least 50% of the data is above or equal to this (median) score. It is observed that E1 has a median of 2 (Disagree) and thus at least the first half of the ordered data indicates a negative response.

4.5.7 Objective Five: To determine the impact of supplier quality management on Eskom's power network operations

This objective was to determine how supplier's quality management impacts upon Eskom's power network operations in terms of system performance improvement, reliability enhancement, maintenance cost reduction, safety performance improvement and improved maintainability. In Table 7, it is observed that most (above 70%) of the responses are affirmative when 'Agree' and 'Strongly agree' are combined for all questions. The only exception is question F1 "Eskom's network performance has improved due to my company's quality management of

products and/or services” has an affirmative response of less than 70% (‘Agree’ and ‘Strongly agree’ and when combined is 69%). All questions pertaining to the mentioned objective are shown in Table 7.

Table 7: Objective Five – Supplier quality impact on Eskom Operations

Supplier Quality Impact on Operations		Freq	Percent
F1 Eskom's network performance has improved due to my company's quality management of products and/or services.	Strongly disagree	0	0%
	Disagree	0	0%
	Neutral	25	31%
	Agree	34	41%
	Strongly agree	23	28%
	Total	82	100%
F2 Maintainability of Eskom's networks has been enhanced due to my company's quality management of products and/or services supplied to Eskom.	Strongly disagree	0	0%
	Disagree	0	0%
	Neutral	18	22%
	Agree	41	50%
	Strongly agree	23	28%
	Total	82	100%
F3 My company's quality management system of products and/or services has helped Eskom reduce its network operating costs.	Strongly disagree	0	0%
	Disagree	0	0%
	Neutral	23	28%
	Agree	39	48%
	Strongly agree	20	24%
	Total	82	100%
F4 Quality management of products and/or services supplied to Eskom helped improve its network reliability.	Strongly disagree	0	0%
	Disagree	0	0%
	Neutral	13	16%
	Agree	40	49%
	Strongly agree	29	35%
	Total	82	100%
F5 Quality management of products and/or services supplied to Eskom helps it to operate its networks safely.	Strongly disagree	0	0%
	Disagree	0	0%
	Neutral	4	5%
	Agree	35	43%
	Strongly agree	43	52%
	Total	82	100%

The bar chart, Figure 4.6, compares the median response per question. The Likert scale is as follow: 1=’ Strongly disagree’, 2=’Disagree’, 3=’ Neutral’, 4=’ Agree’ and 5=’ Strongly agree’.

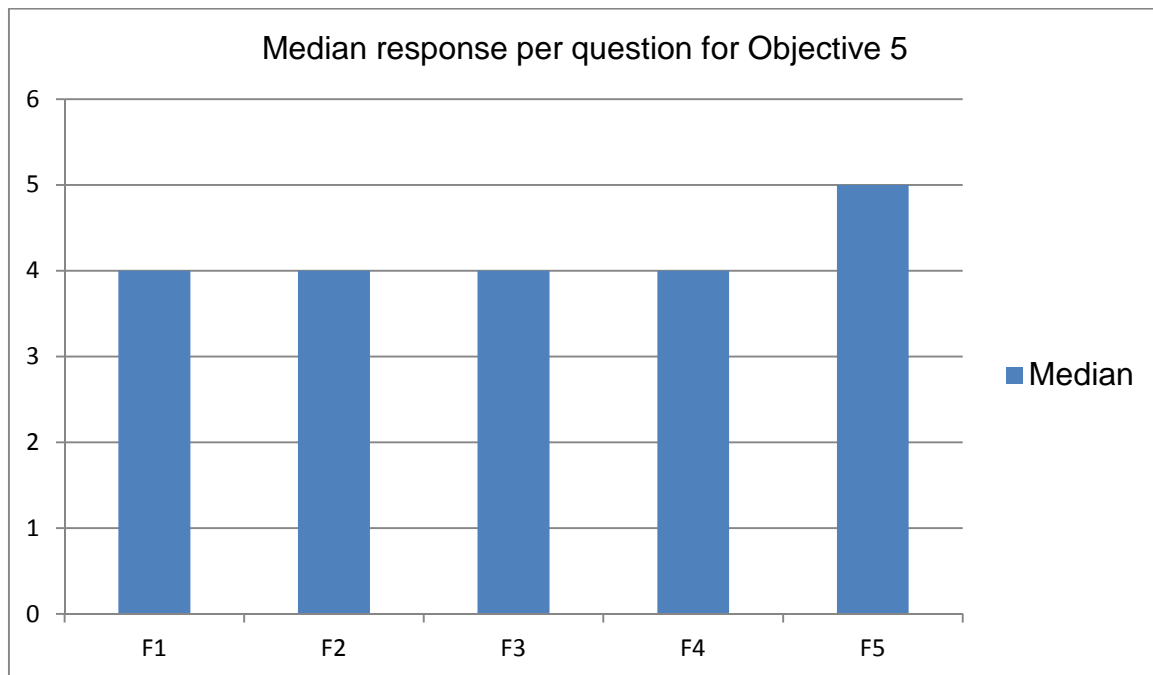


Figure 4.5 Comparison of the median response per question for Objective Five

The labels F1, F2, F3, F4 and F5 in Figure 4.5 correspond with numbering sequence for each question in Table 6. It is observed that the median for each question is the same for all questions (Agree) except for question 5 (Strongly Agree). The median score is the centre value (when ordering the data from small to large) and thus indicates that at least 50% of the data is above or equal to this (median) score, meaning that at least half of the respondents responded affirmatively to a specific question.

4.5.8 Correlation of “Time as Eskom Supplier” vs Responses for Objective Five

The researcher considered it important to investigate the supplier’s responses to questions for Objective Five and the length of time the supplier has been involved with the provision of products and services to Eskom. The aim was to ascertain if there was any significant difference between Eskom’s long term suppliers and those who were short to medium term suppliers. Objective Five was selected owing to its particular importance to the outcome and aim of this research project.

The time demarcation of 10 years was used to demarcate suppliers who were transacting with Eskom for a period of 0-10 years and those over 10 years. In Table 8, it is observed that off the 82 respondents, the numerical split between suppliers of 10 years and less and those over 10 years is almost evenly balanced at 39 and 43 respectively. For Question F1, the responses between both groups are closely related. For Question F2, a significant difference exists in both the “Neutral” responses (26%) and the grouped “Agree” and “Strongly Agree” responses (21%). For Question F3, a similar significant difference exists in both the “Neutral” response (25%) and the grouped “Agree” and “Strongly Agree” responses (24%). For Question F4, the differences observed are marginal with a 12% difference in the “Neutral” responses, 5% in the “Agree” responses and 8% in the “Strongly Agree” responses. For Question F5, the responses are close.

Table 8: Correlation between time and responses to Objective Five

Questions and Responses		10 yrs and less		Over than 10 yrs	
		Freq	Percent	Freq	Percent
F1 Eskom's network performance has improved due to my company's quality management of products and/or services.	Strongly disagree	0	0%	0	0%
	Disagree	0	0%	0	0%
	Neutral	13	34%	12	28%
	Agree	16	41%	18	42%
	Strongly agree	10	26%	13	30%
	TOTAL	39	100%	43	100%
F2 Maintainability of Eskom's networks has been enhanced due to my company's quality management of products and/or services supplied to Eskom.	Strongly disagree	0	0%	0	0%
	Disagree	0	0%	0	0%
	Neutral	13	34%	5	12%
	Agree	16	41%	25	58%
	Strongly agree	10	26%	13	30%
	TOTAL	39	100%	43	100%
F3 My company's quality management system of products and/or services has helped Eskom reduce its network operating costs.	Strongly disagree	0	0%	0	0%
	Disagree	0	0%	0	0%
	Neutral	16	41%	7	16%
	Agree	12	32%	27	63%
	Strongly agree	11	27%	9	21%
	TOTAL	39	100%	43	100%
F4 Quality management of products and/or services supplied to Eskom helped	Strongly disagree	0	.0%	0	0%
	Disagree	0	.0%	0	0%
	Neutral	9	22%	4	9%

improve its network reliability.	Agree	18	46%	22	51%
	Strongly agree	12	32%	17	40%
	TOTAL	39	100%	43	100%
F5 Quality management of products and/or services supplied to Eskom helps it to operate its networks safely.	Strongly disagree	0	.0%	0	0%
	Disagree	0	.0%	0	0%
	Neutral	3	8%	1	2%
	Agree	14	36%	21	49%
	Strongly agree	22	56%	21	49%
	TOTAL	39	100%	43	100%

4.5.9 Correlation of “Supplier ISO 9000 Accreditation” vs Responses for Objective Five

The researcher also considered it important to investigate the correlation between supplier’s responses to questions for Objective Five and supplier ISO 9000 accreditation. Objective Five was selected owing to its particular importance to the outcome and aim of this research project. ISO 9000 accreditation was used as a supplier categorisation to determine whether ISO 9000 accreditation influences supplier responses. In Table 9, it is observed that of the 82 respondents, the numerical split between suppliers ISO 9000 accredited suppliers and non-ISO 9000 accredited suppliers is 20 (24%) and 62 (76%) respectively. This implies that only a small proportion of suppliers have formally accredited and auditable quality management systems in accordance with international standards for quality. For the majority of the suppliers which are not ISO 9000 accredited, the suppliers have informal or in-house quality programmes that are not benchmarked according to international standards.

For Question F1 in Table 9, 20% of the ISO accredited suppliers responded with neutral “Neutral” as against 34% of non-accredited suppliers. For ISO accredited suppliers, 80% chose grouped “Agree” and “Strongly Agree” responses against 66% of non-accredited suppliers. These percentages reflect a higher degree of confidence amongst ISO accredited suppliers that their products and services positively impact upon Eskom’s power network performance.

For Question F2, 10% of the ISO accredited suppliers responded with “Neutral” as against 26% of non-accredited suppliers. For ISO accredited suppliers, 90% chose

grouped “Agree” and “Strongly Agree” responses against 74% of non-accredited suppliers. The higher proportion of non-ISO accredited suppliers who responded as “neutral” illustrates the ambivalence and uncertainty amongst them on the impact of their quality systems on maintainability of Eskom’s power networks. The converse is true of the ISO accredited suppliers where most express significant confidence in their quality management systems relating to maintainability.

For Question F3, 15% of the ISO accredited suppliers responded with “Neutral” as against 33% of non-accredited suppliers. For ISO accredited suppliers, 85% chose grouped “Agree” and “Strongly Agree” responses against 67% of non-accredited suppliers. ISO accredited suppliers responded with greater certainty about cost reduction achieved on Eskom’s networks as their processes are measured and controlled. Non ISO accredited organisations’ quality systems are technically less onerous and is reflected in the extent of their uncertainty about cost reduction.

For Question F4, 20% of the ISO accredited suppliers responded with “Neutral” as against 14% of non-accredited suppliers (6% difference). For ISO accredited suppliers, 80% chose grouped “Agree” and “Strongly Agree” responses against 86% of non-accredited suppliers (6% difference). The correlation between the two categories is much closer for this question. From the fact that both ISO and non-ISO contractors responded in similar proportions, shows that both groups almost equally believe that their products assist Eskom in achieving network reliability targets. This has positive implications for Eskom’s drive to meet its NERSA licence obligations.

For Question F5, 0% of the ISO accredited suppliers responded with “Neutral” as against 6% of non-accredited suppliers. For ISO accredited suppliers, 100% chose grouped “Agree” and “Strongly Agree” responses against 94% of non-accredited suppliers. The correlation in responses for this question was much closer. The implication of the responses to this question reflects a common understanding and sense of purpose amongst all suppliers about the criticality of operational safety. The unanimous responses of both groups of suppliers on safe working procedures for employees and importance of safety to the public crosscuts any distinction based on ISO 9000 accreditation.

Table 9: Correlation between “ISO 9000 Accreditation” vs Response to Objective Five

Questions and Responses		Yes		No	
		Freq	Percent	Freq	Percent
F1 Eskom's network performance has improved due to my company's quality management of products and/or services.	Strongly disagree	0	0%	0	0%
	Disagree	0	0%	0	0%
	Neutral	4	20%	21	34%
	Agree	11	55%	23	37%
	Strongly agree	5	25%	18	29%
	TOTAL	20	100%	62	100%
F2 Maintainability of Eskom's networks has been enhanced due to my company's quality management of products and/or services supplied to Eskom.	Strongly disagree	0	0%	0	0%
	Disagree	0	0%	0	0%
	Neutral	2	10%	16	26%
	Agree	10	50%	31	50%
	Strongly agree	8	40%	15	24%
	TOTAL	20	100%	62	100%
F3 My company's quality management system of products and/or services has helped Eskom reduce its network operating costs.	Strongly disagree	0	0%	0	0%
	Disagree	0	0%	0	0%
	Neutral	3	15%	20	33%
	Agree	12	60%	27	43%
	Strongly agree	5	25%	15	24%
	TOTAL	20	100%	62	100%
F4 Quality management of products and/or services supplied to Eskom helped improve its network reliability.	Strongly disagree	0	0%	0	0%
	Disagree	0	0%	0	0%
	Neutral	4	20%	9	14%
	Agree	9	45%	31	50%
	Strongly agree	7	35%	22	36%
	TOTAL	20	100%	62	100%
F5 Quality management of products and/or services supplied to Eskom helps it to operate its networks safely.	Strongly disagree	0	0%	0	0%
	Disagree	0	0%	0	0%
	Neutral	0	0%	4	6%
	Agree	6	30%	29	47%
	Strongly agree	14	70%	29	47%
	TOTAL	20	100%	62	100%

4.6 Qualitative Data

Qualitative data, on the perceptions of Eskom's Field Services employees on supplier quality management impact on network operations, was compiled from 41 structured interviews which accounts for the phenomenological dimension of this

study. The structured interview questionnaire is located in Appendix D. The structured interview outcome was compiled based on the following aspects:

- Eskom's employees' understanding of total quality management;
- Perceptions of suppliers' commitment to quality management;
- Eskom's employees' experience related to suppliers' focus on customer satisfaction;
- Effectiveness of quality control measures in the supply of products and services;
- The views of Eskom's employees on the impact of supplier quality management on network performance, reliability, maintainability and safety;

The framework for reporting the data from the structured phenomenological interviews follows the sequence of the research objectives. The data is consolidated into themes as indicated above and presented as summated results in the form of frequencies and percentages.

4.6.1 Overview of Eskom Field Services Staff Profile

Table 10 presents background data describing Eskom Field Services Department employees who are directly impacted in their daily activities by supplier products and services. Field Services Department employees are responsible for daily management of Eskom's power network operations. None of the variables (responses to the questions) have equal probability. Applying the chi square test to the qualitative data, the calculation yielded a p-value of 0.002 and 0.001 respectively which is considered statistically not significant.

The structured interviews were directed at Field Services managers, engineers, senior supervisors and works coordinators. The former two categories (managers and engineers) serve in an operations managerial capacity and the latter two (senior supervisors and works coordinators) in an operations execution capacity.

Table 10: Eskom Field Services Department employee profile and views on total quality management

Question and Categorisation of Eskom Employees		Freq	Column N %	p value
What is your job designation in Eskom?	Senior Supervisor	19	46%	0.002
	Works Coordinator	13	32%	
	Field Services Engineer	6	15%	
	Field Services Centre Manager	3	7%	
	Other	0	0%	
	Total	41	100%	
What is your length of service in Eskom's employment?	0-5yrs	5	12%	<0.001
	6-10yrs	6	15%	
	Over 10yrs	30	73%	
	Total	41	100%	
What is your view of Total Quality Management as applicable to products and services provided by suppliers, contractors and consultants to Eskom?	total quality management is unimportant for services to Eskom (a)	0	0%	<0.001
	total quality management does not impact Eskom's operations (b)	0	0%	
	total quality management is very important to services received by Eskom (c)	2	5%	
	total quality management is critical for sustainability of Eskom's operations in the future (d)	3	7%	
	I agree with (a) and (b) above	0	0%	
	I agree with (c) and (d) above	36	88%	
	Total	41	100.0%	

From Tables 10 and 11, it is observed that the latter two categories of employees comprise 78% of the respondents. In years-of-service terms, 73% of the employees have been employed for 10 years or more, 15% between 5 and 10 years and 12% for less than 5 years. The critical role of total quality management in services received by Eskom and its impact upon network operations is acknowledged by 88% of employees.

Table 11 provides more insight into the nature of Eskom Field Services employee profile in terms of service history for each category of employee who participated in the structured interviews. In each staff category, a significant majority of the staff have over 10 years of service with Eskom. Eskom's employees were presented with a range of questions on their experiences with suppliers' product and service quality.

Table 11 – Eskom employees profile: Years of service vs Eskom employee job designation

Eskom Employee Job Designation		What is your length of service in Eskom's employment?			
		0-5yrs	6-10yrs	Over 10yrs	Total
		Freq	Freq	Freq	Count
What is your job designation in Eskom ?	Senior Supervisor	0	4	15	19
	Works Coordinator	2	1	10	13
	Field Services Engineer	3	1	2	6
	Field Services Centre Manager	0	0	3	3
	Total	5	6	30	41

4.6.2 Link between Employee Service History and Perceptions of Quality

This section relates to Objective One of the study. Is there a link between the length of service of Eskom's Field Services Department and perceptions of the critical importance of product and service quality?

Table 12 displays the frequencies when comparing the Eskom employee service length and each of the employees' view regarding Eskom supplier/contractor/consultant TQM applicable to services provided. Although it is evident from the table that those with more experience agree that the suppliers must have a TQM system in place, it is not statistically significant (p value: 0.568).

Table 12 illustrates that all of the respondents agree on total quality management as being very important.

Table 12: Link between length of service and importance of supplier quality

		Length of service in Eskom's employment			
		0-5yrs	6-10yrs	Over 10yrs	Total
		Freq	Freq	Freq	Count
What is your view of Total Quality Management as applicable to products and services provided by suppliers, contractors and consultants to Eskom?	Total quality management is very important to services received by Eskom (c)	0	1	1	2
	Total quality management is critical for sustainability of Eskom's operations in the future (d)	0	0	3	3
	I agree with (c) and (d) above	5	5	26	36
	Total	5	6	30	41

4.6.3 Eskom Employees Perception of Supplier Commitment to Quality Management

The qualitative data discussion in this section relates to Objective Two of this study. Eskom's Field Service Department employees were presented with questions on their perceptions of suppliers' commitment to ensuring quality in their products and services. The questions are listed in Section B of the interview schedule contained in Appendix D.

For Question C1, 83% of the employees believe suppliers have either a slight or medium level involvement in ensuring effective quality management whilst 7% and 10% consider suppliers to have no or full involvement respectively. For Question C2, 66% of employees noted that suppliers display satisfactory or full continual improvement whilst 34% believe that there is some evidence of continual improvement. For question C3, on suppliers who have clearly defined quality policies, 51% of employees think that these suppliers contribute towards building high quality networks whilst 49% believe they help to improve network performance. For Question C4, on competence of supplier's resources, 64% of employees are satisfied with competence levels but feel suppliers should invest more in training, 34% believe suppliers resources have low levels of skill, 2%

believe supplier resources are incompetent and 0% believe suppliers have highly competent resources.

4.6.4 Eskom Employees satisfaction with the current levels of supplier product and service quality

This section is linked to Objective Three of this study. Responses from Eskom employees to questions in Section D of the interview questions (Appendix D) highlights evidence of the lack of involvement from suppliers, dissatisfaction on communication from suppliers, final quality inspections and fulfillment of Eskom's requirements of the contractors.

On Question D1, relating to involvement of suppliers in meeting network operational requirements, 46% of Eskom employees responded that suppliers only become involved after being requested to do so, 37% have partial involvement, 10% are proactively involved and 7% display no involvement at all. Only 10% of the employees indicated that suppliers are proactive in their involvement.

In response to question D2, none of the employees view the suppliers' communication as "excellent", 34% consider communication to be satisfactory whilst the rest express unfavourable views with 42% stating that it is unsatisfactory and a further 24% who believe communication to be minimal.

For Question D3, a paltry 3% of employees indicated that quality inspections are fully done, 46% stated that inspections are not thoroughly done, 46% reported inspections are inadequate and 5% expressed the view that no inspections are done.

For Question D4 relating to the methods suppliers use to verify fulfillment of Eskom's requirements, 52% of the employees reported that methods are only partially used by suppliers whilst the rest of the employees were evenly divided between no methods being used, various methods being used, pre-delivery inspections being done and check sheets being implemented for products and services.

4.6.5 Eskom Employees Perception of the Effectiveness of Supplier Quality Control Measures

This section is linked to Objective Four of this study. The views of Eskom's employees were solicited to assess the effectiveness of quality management controls instituted by suppliers of products and services provided to Eskom. The interview questions pertaining to the mentioned objective are contained in Section E of Appendix D. It is observed from the nature of the responses that Eskom's employees expressed negative sentiments about suppliers' quality control measures, consider suppliers approach to addressing non-conformances as reactive and believe the recurrence of repeat non-conformances are widespread.

For Question E1 on adequacy of quality controls, 41% of Eskom's employees believe the quality control to be insufficient, 39% consider quality control to be a random occurrence, 15% categorically stated that quality control is non-existent and a small minority (5%) expressed the view that quality control is adequate. On Question E2 relating to conformance to Eskom's network requirements, majority of the interview respondents (61%) expressed the favourable view that Eskom's requirements are often met by suppliers, a substantial minority (34%) who stated that Eskom's requirements are rarely met and 5% of the views evenly divided between requirements always being met and requirements never being met. Question E4 dealt with suppliers' mechanisms to identify and rectify non-conformances. Majority of Eskom's employees believe that suppliers respond reactively to non-conformances i.e. the suppliers only react to non-conformances when identified by Eskom's personnel while 12% stated that suppliers rarely action non-conformances and 10% considered suppliers to be inconsistent in their attempts to correct non-conformances. Question E5 relates to suppliers' controls for the prevention of repeat non-conformances. Majority of Eskom's employees provided an unfavourable assessment of existing non-conformance prevention controls with 73% stating controls are ineffective and 5% who believe controls are non-existent. This unfavourable assessment contrasts with 20% of the employees who stated that non-conformances are rarely repeated and a further 2% who consider non-conformance prevention controls are good.

4.6.6 Eskom Employees Perception of the Impact of Supplier Quality Management on Power Network Operations

This section relates to Eskom's employees views on Objective Five of the study i.e. supplier impact on dimensions of power network operations. The questions are contained in Section F of the interview questions contained in Appendix D.

For Question F1 on network performance, 15% of employees reported a significant improvement in network performance, 41% reported a slight improvement in performance, 15% stated there is no impact on performance and 29% view network performance as having deteriorated.

Question F2 queries suppliers' impact on maintenance efficiency. From the responses of the employees, 29% felt less maintenance was required, 22% believed there was no effect on maintenance, 12% stated that maintenance frequency had increased, 17% expressed the view that maintenance has become easier and 20% stated there are more defects on networks.

Employees expressed their views on the effect of supplier quality on maintenance costs in response to Question F3. According to 44% of the interviewees, maintenance costs have increased, 34% indicated there is no impact on maintenance costs and 22% reported a reduction in maintenance costs.

Achieving of power network reliability targets comprise a major portion of Eskom's operations. Supplier quality impact on network reliability was the focus of Question F4. The view expressed by 44% of the employees is that there is marginal improvement in network reliability, 22% indicated there is no change in the reliability indices, 20% stated that reliability has become significantly better and a minority (14%) considered reliability to be slightly worse off. None of the employees expressed the view that reliability has significantly worsened.

Power network fault outage restoration time was the object of Question F5. Of the employees interviewed, 37% stated that restoration times remained unaffected, 34% viewed the restoration times to have slightly improved, 12% said there was

significant improvement, 15% believed the restoration times have slightly worsened and 2% replied that restoration times have significantly worsened.

4.6.7 Recommendations from Eskom's Employees for Possible Improvement in Supplier Quality Management

As part of the structured interviews, Eskom employees were asked to recommend areas of supplier quality management that could be improved or enhanced. It is observed that three recommendations were made by more than 50% of the respondents:

- 66% recommended focus on training, education, skills and competency development.
- 63% recommended greater compliance to Eskom's requirements and specifications.
- 54% recommended improving quality of workmanship.
- 42% recommended communication from suppliers be enhanced.
- 37% recommended suppliers increase the frequency of quality inspections.
- 27% recommended reduction in defects.
- 24% recommended improvements in equipment used on Eskom's networks.

4.7 Summary

The multi-methods approach deployed for this research study afforded a useful insight into the research study aim and objectives. The study was based on data gathered from a questionnaire presented to 82 Eskom suppliers and structured phenomenological interviews with 41 Eskom employees involved with network operations. In total, the study attracted 123 participants. Quantitative data analysis was conducted initially by the consolidation of respondents' information into Excel worksheets and thereafter exported to SPSS version 18 for statistical analysis. The outputs from SPSS are contained within tables and figures.

For the quantitative data analysis, the twenty five questions contained in the research instrument were grouped according to the research objectives. The research instrument used was based on the Likert approach and Eskom's

suppliers' responses were categorised accordingly. Associations between two categorical variables were tested using the Chi-square test and reported the statistical significance of the Pearson test or Fischer's Exact test were more appropriate. Cronbach's Alpha Coefficient Test was used to determine the reliability of the quantitative data. Due to the categorical nature of the data frequencies and percentages were presented in the tables. Bar charts were displayed with corresponding counts for each Likert scale variables. The bar charts displaying Likert scale questions show the median response per question as a measure of location.

The qualitative data analysis, based on structured interviews with Eskom employees, provided the basis for the phenomenological dimension of the study. Techniques such as Pearson's correlation, frequencies and percentages were used as statistical tools. It was observed that the combination of quantitative and qualitative data highlighted areas of convergence and divergence on key concepts of quality management between suppliers' application of quality management and Eskom's employees lived experience in respect of Eskom's power network operations.

This chapter on data analysis is followed in the next chapter by discussion of the data based on the themes identified in the literature review of Chapter Two. This shall lead to recommendations based on findings from the study, identifying the limitations of this study, suggestions for further research and a conclusion to the study.

CHAPTER 5

DISCUSSION

5.1 Introduction

In the previous chapter, the focus was on the presentation of research results in the form of tables and figures. In this chapter, data gathered for each research objective is used for analysis and discussion. The tables and figures from Chapter Four are used to assist in categorising and codifying data to enable the researcher to identify trends, areas of convergence, divergence and correlation between quantitative and qualitative data.

In this chapter, each research objective is discussed together with its sub-elements against the backdrop of the literature survey detailed in Chapter Two. Importantly, the conceptual framework from the literature survey is linked into the discussion of the research results. For each objective, the researcher leads discussion with the relevant theory, followed by a discussion of the quantitative data analysis and locates the argument in the context of Eskom's employees experiences (phenomenology) (Cresswell 2007, Goddard & Melville 2006, Blaxter et al 2006)

The following aspects are discussed in this chapter:

- Prevailing understanding of TQM
- Supplier commitment to quality
- Customer focus and satisfaction
- Supplier quality control measures
- Supplier quality management impact on technical operations
- Influence of supplier transaction history on response
- Influence of supplier ISO 9000 accreditation on responses

5.2 Supplier Profile

The 82 supplier respondents to the questionnaire comprised of 58% electrical

contractors, 20% product manufacturers, 17% electrical engineering consultants and 5% electrical hardware distributors. As indicated in Chapter Four, the supplier population for this study, based on the SAP system download and applying the criteria of transaction value, is 187 suppliers with a total transaction value of R2.83 billion. The population sample was therefore 44% and deemed adequate to draw conclusions about the aim and objectives of this research study. The supplier categories participating in this study are fully and comprehensively representative of all the suppliers who impact upon Eskom's network operations. The researcher is confident that there are no other supplier categories which have been either wittingly or unwittingly omitted from this research study.

Although Eskom's corporate procurement policy explicitly requires suppliers to be ISO 9000 compliant and accredited, the study revealed that only 24% of the respondents were accredited whilst 76% were not. The rationale for probing this distinction between suppliers is to understand if there's a causal relationship in responses to the questionnaire between accredited and non-accredited suppliers.

The quantitative data analysis indicates that 52% of the suppliers have transacted with Eskom for 10 years or more, 23% between 5 and 10 years and 22% for less than 5 years. This indicates that the majority of the respondents have been engaged with Eskom in product and service provision for a prolonged period. For suppliers to engage with Eskom on a commercial basis, they are required to imbue themselves with detailed knowledge of Eskom's standards, specifications, procedures and contractual requirements. It substantiates the view that by virtue of the prolonged nature of the business relationship with Eskom, the majority of the suppliers are fully conversant with the quality requirements of the products and services provided. This factor is important in that it underscores the maturity and the depth of the business relationship between Eskom and its suppliers thereby reinforcing the credibility of this research study.

5.3 Eskom Employee Profile

A total of 41 Eskom Field Services Department employees, from a target group of 62, participated in structured interviews which formed the basis of qualitative data

compiled for this research study. The job designations of the target group included Field Service Centre Managers, Field Service Engineers, Senior Supervisors and Works Coordinators. The former two categories are mainly managerially oriented, strategically-minded operational staff whilst the latter two categories are primarily focused on practical implementation of network operations.

The responses indicate that the employees who participated in structured interviews are comprised of 46% senior supervisors, 32% works coordinators, 15% are field services engineers and 7% managers. By virtue of their location, dispersion and level within the Field Services Department hierarchy, the majority of the interviewees (78%) are involved with conducting daily network operations whilst the other 22% perform their duties in a strategic and managerial capacity. The quality of the research outcome is enhanced by ensuring that a cross-section of network operations personnel participated in the phenomenological dimension of this study.

The information on the network operations personnel profile indicates that the majority (73%) of the staff who participated in the structured interviews have over 10 years of service in Eskom, 15% have between 6 and 10 years of service history and a small percentage (12%) have less than 5 years of service history. The responses provided by Eskom's network operations staff is therefore based on a substantial knowledge, information and experiential resource base. The research outcome is enriched by the informed responses of the interviewees and lends credence to the conclusions derived from the study.

5.4 Objective One: Total Quality Management (TQM)

This objective was to determine the understanding held by Eskom's suppliers on the concept of Total Quality Management. The goal of TQM is about excelling in the provision of products and services to the customer through management of an organisation in such a way that every dimension of its operations is oriented towards this achievement (Chase et al 2006). TQM requires meticulous design of a product or service and consistent reproduction of that design by ensuring the integrity of organisational systems. TQM is a philosophy which is adopted as a

way of thinking and working with the end goal of exceeding customer's expectations (Pycraft et al 2004). Among the early pioneers of quality concepts, Juran stated that the focus of quality management should be the improvement of the entire system while Ishikawa advocated a broadly inclusive definition of quality which should be infused within every facet of an organisation (Summers 2009).

Suppliers are required to respond to five dimensions of TQM and their responses are discussed.

5.4.1 Officially Documented Quality Management Policy

Is it important for suppliers to have an officially documented quality management policy? Among others, an accreditation requirement of ISO 9000 is for organisations to have an officially documented quality management system policy. Juran's famed quality trilogy included the need for quality planning (Kruger et al 2005). From supplier responses, 63% and 32% responded with "Strongly Agree" and "Agree" responses respectively, 3% were "neutral" and 1% "disagreed" with the need for officially documented quality policies. An overwhelming majority of suppliers affirmed the importance of having an official quality management policy within their organisations.

5.4.2 Staff Knowledge of Quality Objectives

Each employee, at every level in all departments and activities need to work together to strive to meet the quality aims of the organisation (Muhlemann et al 1992). One of the three main pillars for successful organisations is full employee involvement in TQM from defining internal and external customers, correcting errors at points of occurrence (quality at source), use of teamwork to achieve pre-determined goals and empowerment of employees with decision-making ability to solve operational problems in their area of responsibility (Krajewski et al 2010). In his work, Crosby promoted the establishment of quality teams, Deming stressed the importance of empowering employees to achieve quality goals and Juran mooted the quality circle approach (Chase et al 2006).

Does Eskom's supplier's staff possess knowledge about the quality management

objectives set for products and/or services provided by their organisations? According to the responses, 90% responded positively, 7% were neutral, 2% disagreed and 1% strongly disagreed. Suppliers appear to be in general agreement with the established theory of ensuring their employees are conversant with quality objectives of their respective organisations. However, a small minority of suppliers disagreed (2%) or strongly disagreed (1%). This indicates that there are suppliers who have not yet interwoven their product and service quality objectives within all dimensions of their operations.

5.4.3 Quality Cost Optimisation

According to Barnes (2008), the expenditure required to institute product and service improvement proposals may be equated to costs to improve quality. Although all organisations may consider quality management as beneficial, it comes at a cost. These costs may become considerable depending on the extent and depth of quality enhancement projects undertaken (Heizer & Render 2011). Investment in quality management enhancement initiatives are categorised into four main areas viz, prevention costs that ensure defects do not occur, appraisal costs associated with quality control, internal failure costs incurred in rectifying system failures caused by errors and external failure costs where customers have identified failures (Evans & Lyndsay 2010).

Do Eskom's suppliers consider their organisations to have fully optimised the cost of providing quality effort with costs of internal / external failure? Supplier responses indicate that 33% of suppliers "strongly agree" that they have done so, 46% "agree", 20% are "neutral" and 1% "disagree". The responses confirm that the majority of the suppliers have made a conscious attempt at reviewing their quality costs and have optimised the costs thereof. A significant proportion (20%) are non-committal which could imply this dimension has not been considered within their operations and 1% indicated that there is still room for further optimisation of the cost of quality.

5.4.4 Improvement of Productivity by TQM

TQM is often implemented in organisations as a response to the emergence of

competitors and represents an attempt at maintaining competitive advantage (Wilkinson et al 1998). Oakland (1993) stated that using TQM to improve productivity and efficiency is one of the most important instruments in a competitive environment. Eskom's suppliers are located in a highly competitive market for the products and services provided to power utilities.

What is the response of suppliers on TQM enhancing productivity and efficiency within their operations? A total of 54% of suppliers responded as "strongly agree", 40% "agree" whilst 6% are undecided about whether TQM has a favourable or unfavourable impact on productivity and efficiency. Most of the suppliers state that TQM has a positive effect on their operations efficiency and this finding resonates with the theory of productivity improvement in intensely competitive environments.

5.4.5 Occasional Problems with Defects

There are two manifestations of defective products or services viz. internal and external failures. Internal failures are defects identified within the systems of an organisation. External failures are those defects that pass through the operational controls and are identified by the customer (Schroeder et al 2011). Depending on the efficacy of the quality control instituted by an organisation, the defects are identified either within the operation or by the customer.

Do Eskom's suppliers experience occasional problems with quality management of products and/or services? A small percentage (2%) of suppliers "strongly agree" that occasional problems do exist, 50% "agree" they do have problems, 23% percent are "neutral", 20% "disagree" and 5% "strongly disagree". This is an acknowledgment on the part of majority of the suppliers that internal and external failures of their quality management systems occur. The scope of the study did not allow for interrogation into the relevance of ISO accreditation of each supplier to the proportion of those suppliers who admit to having quality problems. The significant proportion of suppliers who responded as "neutral" indicates these suppliers do not have a firm understanding of quality defect management. Considering the grouped "strongly disagree" and "disagree" responses, a significant proportion of suppliers consider their products to be error-free.

5.4.6 Eskom Employees Perception of TQM

The Eskom employees interviewed consider TQM as a basic and fundamental requirement to be fulfilled for the long term health of Eskom's operations. All employees consider TQM to play a key role in products and services provided to Eskom. Of the employees interviewed, 88% believe that TQM is both critical as well as very important signifies the importance that Eskom employees attach to TQM. There was no appreciable difference in the length of service of each employee interviewed versus the selection of the responses.

5.5 Objective Two: Supplier Commitment to Quality

According to the Evans & Lyndsay (2007), Crosby stated that top management in organisations is responsible for quality deliverables. Deming identified top management as being responsible for 94% of quality related problems and Juran concluded that less than 20% of quality problems may be attributable to employees (Chase et al 2006). The quality pioneers are consistent in their view that top management fulfill a critical role in managing quality within their organisations.

5.5.1 Visible Supplier Commitment to Quality

In analysing the work of Deming, Schroeder et al (2011) states the key role played by an organisation's top management in improving product or service quality. Top management is required to lead by example and to be present at the point where production takes place so that employees are constantly engaged in improving quality of the product or service. Together with visibility, top management is required to provide employees with the systems and support to achieve quality objectives. Top Management is required to institute procedures, methods and controls to ensure effective quality management is achieved (Kruger et al 2005).

Is the top management of Eskom's suppliers practically and visibly committed to meeting Eskom's technical quality requirements? From the supplier responses, 83% "strongly agree" and 17% "agree" that top management in their organisations display visible commitment. In the phenomenological study, a significantly different perception emerges amongst Eskom employees. Among Eskom employees, it is

observed that only 10% believe suppliers top management display full commitment to meeting Eskom's requirements whilst the other 90% of employees consider suppliers to have limited or slight involvement. A disconnect between supplier responses and the experience of Eskom employees exists. Slack et al (2005) stated that this mismatch is referred to as a quality gap whereby a customer's perception fails to coincide with a supplier's delivered product or service.

5.5.2 Implementation of Continual Improvement

A strategic approach is required by any organisation that prioritises the implementation of continuous improvement (Slack et al 2004). The term "kaizen", originally coined by Mazak Imai, referred to continuous improvement that required constant, incremental and perpetual improvement of quality (Bamford & Forrester 2010). Deming emphasised the need for continuous improvement to reduce the risk of variation in quality (Schroeder 2011).

Have suppliers implemented effective continual improvement strategies for products and services procured by Eskom? Except for 1% of the suppliers who indicate a "neutral" response, the rest of the suppliers responded with "agree" or "strongly agree" which indicates that suppliers are wholly committed to improvement of their products and services. How does this commitment translate into the experience of Eskom employees? There is consistency between the responses of suppliers and the experience of Eskom employees. There is acknowledgement by 24% of Eskom employees that all suppliers display evidence of continual improvement, 42% believe that it is at a satisfactory level and 34% are able to identify partial evidence of continual improvement. Whilst the suppliers responses serve as an indication of their practical commitment to continuous improvement, Eskom employees validate this observation in the interview responses. The only difference in Eskom employee's perceptions of continual improvement is the scale of continuous improvement and not whether suppliers display evidence of it.

5.5.3 Quality Management Policies for Products and Services

Majority of the suppliers (94%) indicate that they “strongly agree” and “agree” that quality procedures are implemented in their organisations whilst 5% registered “neutral” responses. The unanimity in supplier responses signifies the extent to which quality procedures for products and services are documented. This may appear to contradict the high percentage of suppliers (76%) who indicated that they are not ISO accredited. However, the possibility that suppliers have informal quality procedures should not be discounted.

From the interviews, it is evident that Eskom employees support the need for suppliers to have documented quality management procedures. For improvement of power network performance, 49% of Eskom’s employees considered documented quality management procedures important whilst 51% indicated it helps with building high quality networks. No employee considered it as unimportant or without impact on network quality. Both, suppliers and Eskom’s employees, are in agreement that documented quality procedures are fundamentally crucial.

5.5.4 Supplier Staff Skill and Competence

Juran argued that for effective quality improvement, employees should be appropriately skilled and most importantly, need to comprehend techniques required for products and service provision (Summers 2009). In his work, Deming mentioned the role of workers in compromising quality whilst Ishikawa stressed the need for people participation in problem-solving and hybrid use of human-oriented and statistical techniques for quality circles (Pycraft et al 2004).

The research study indicates that 51% of suppliers “strongly agree” their staff are trained, skilled competent and capable of meeting quality requirements whilst 45% “agree” this to be the case as well. A small proportion of suppliers (4%) were “neutral” in their response and it reflects a measure of ambivalence in staff capabilities. In accordance with the literature on the role of employee skill, capability and training, most of the suppliers affirmed their confidence level in the competence of their staff.

Compared to the quantitative data analysis, a contrasting image of supplier staff skills, competence and capability emerges from the phenomenological dimension of the research study. None of the Eskom employees interviewed consider supplier staff to be highly skilled, 64% believe that suppliers staff are competent but in need of ongoing training, 34% express the view that supplier staff have low competence levels and 2% think that supplier staff are poorly trained and lack skills. The research study has accentuated the discrepancy between supplier self-belief in the competence of their staff and the actual experience of Eskom's employees from their interaction with suppliers. Eskom's employees do not share the favourable view of supplier's staff skill levels.

5.5.5 Supplier Product and Service Reviews

Kruger et al (2005) stated that there is a need to constantly review the processes and systems to improve products and services. Post-production inspections and defect remediation are not guarantees of quality. The quality concept pioneers first articulated the idea of internal reviews. Deming developed the P-D-C-A cycle, Crosby articulated the "14-step programme" and Juran advocated the idea of a breakthrough sequence. The quantitative data analysis indicates that majority of the suppliers conduct internal product and service quality reviews with a significant proportion (49%) of suppliers "agree" whilst 40% "strongly agree" they conduct reviews. A small proportion of suppliers (5%) responded as "neutral" which indicates these suppliers are doubtful whether internal reviews are conducted within their organisations,

5.6 Objective Three: Customer Focus and Satisfaction

A synthesis of quality programme implementation and superior organisational performance forms the basis for ensuring customer satisfaction (Krajewski 2010). According to Schroeder et al (2011), meeting and/or exceeding customer expectations is integral to the definition of quality. The UK-based CQI stated that customer satisfaction is central to their definition of quality. In the approaches to quality, the user-based approach is premised on customers defining quality requirements in terms of fitness-for-purpose (Slack 2004).

5.6.1 Customer Satisfaction as a Business Goal

One of the early pioneers of quality management – Feigenbaum – defined quality in terms of achieving customer satisfaction and meeting customer requirements as the principal aim of an organisation (Summers 2009). According to Slack et al (2004) quality is essentially about consistent conformance to customer's expectations. Customer satisfaction is described as the pinnacle of quality effort.

From the quantitative data analysis, a significant majority of Eskom suppliers subscribe to the ideal of achieving customer satisfaction. From the responses received, 63% of suppliers “strongly agree” and a further 34% “agree” with customer satisfaction as the aim of their respective business operations. This implies that suppliers have orientated their business operations towards ensuring customer satisfaction. A negligibly small minority of suppliers (3%) indicated a “neutral” response.

Do Eskom's employees perceive customer satisfaction to be the main aim of suppliers operations? From the Eskom interviewee's responses, only 10% of employees reported that suppliers display a fully-fledged commitment to customer satisfaction. The other Eskom interviewees (37%) reported that there is partial commitment to customer satisfaction, 46% of the interviewees reported suppliers are involved only when called upon and 7% reported there is no involvement at all. The study has highlighted a cavernous gap between the supplier's stated commitment to customer satisfaction and the actual level of customer satisfaction experienced by Eskom employees.

5.6.2 Effective Communication by Suppliers

Pycraft et al (2004) stated that a quality gap between actual service and product quality delivered by suppliers and the communicated image of expected quality arises if the marketed attribute of a product does not match its stated attributes. Barnes (2008) referred to this anomaly as an unfulfilled promise made to customers.

In response to the questionnaire, suppliers express belief that communication to

Eskom about the quality of their products and services is effective. The combined “strongly agree” and “agree” responses of suppliers indicate 97% of suppliers consider their communication to Eskom as effective. There is an acceptance amongst most suppliers of the importance of communication about the quality dimension of their products and services. None of the suppliers’ “disagree” or “strongly disagree” with the importance of communication with Eskom.

What are Eskom employees views on the effectiveness of communication by suppliers concerning the quality of the products and services received? Whilst suppliers consider communication to be effective, Eskom employees express a substantially different view. In the experience of Eskom employees, 24% of the interviewees report little or no communication from suppliers and 42% report that the communication level is unsatisfactory while 34% believe the communication from suppliers is satisfactory. None of the Eskom employees interviewed consider supplier communication to be excellent. This study reveals a mismatch between the supplier’s response and Eskom employees views on the effectiveness of supplier communication. The discord between the supplier’s response and the employees experience must be viewed in the context of the communication quality gap that exists.

5.6.3 Supplier Confirmation of Eskom’s Requirements

Section 7 of the ISO 9000 set of standards deals with product realisation. One of the stated requirements is for suppliers to implement a system to verify and validate customer needs in cases where the customer has not specified detail attributes of the product or service required. Majority of the suppliers indicate they have a user-requirement verification system established with 48% who “strongly agree” and 38% who “agree” that an effective verification system is in place. A further 12% are “neutral” and another 2% “disagree” about effectiveness of their systems. This suggests that there is a significant minority of suppliers who are unsure about verifying requirements where such requirements are not explicitly stated by Eskom. Eskom needs to consider effectively managing procurement of products and services which don’t have explicitly defined specifications. This is a potential source of adverse or negative impact upon Eskom’s operations.

5.6.4 Product and Service Quality Feedback

Deming was an exponent of the idea that listening to customers about their needs is central to enabling an organisation to improve the quality of its products and services (Summers 2009). This statement emphasises the centrality of the customer in quality management. The customer plays a pivotal role in providing feedback signals to the supplier on delivered quality. It is thus imperative for suppliers to solicit feedback from customers.

From the supplier data analysis, it was determined that 69% of suppliers always obtain feedback from Eskom concerning their product and service quality. Of these suppliers, 23% indicate they “strongly agree” and 46% “agree” that this is done. Another 27% of suppliers tendered “neutral” responses which could mean they remain unsure or unaware of quality feedback interactions with Eskom, 7% state they “disagree” and 4% “strongly disagree” that feedback is obtained from Eskom. This implies that there is a significant group of suppliers who don’t subscribe to the idea of engagement with Eskom to ascertain whether or not Eskom is satisfied with product and service quality.

5.6.5 Meeting Specified Requirements

For procurement of products and services, Crosby stated that customers need to explicitly communicate their requirements to suppliers. Juran posits the idea of suppliers undertaking surveys to determine customer requirements (Chase et al 2006). According to Schroeder et al (2011), the customer is the sole arbiter of what quality is and suppliers need to acknowledge this. Barnes (2008) stated that comprehending, understanding and meeting customer requirements is a necessary prerequisite for successfully managing quality.

The quantitative data analysis reveals that the grouped together “strongly agree” and “agree” responses accounts for 92% of the suppliers who state they are always able to determine whether or not Eskom’s requirements are fulfilled. This outcome signifies that there are institutional mechanisms in place which enables suppliers to determine if Eskom’s needs are met. A small proportion of suppliers (6%) are “neutral” and a further 2% indicate they “disagree” that they are able to

determine whether fulfillment of Eskom's requirements is achieved.

5.6.6 Eskom Employees View on Fulfillment of Requirements

From the phenomenological interviews conducted with Eskom employees, the interview results corroborate the supplier's responses in respect of the existence of an institutional framework to determine if Eskom's quality requirements are fulfilled. The interview results show that although Eskom employees differ in their views of how this determination is made, there is, nevertheless, some form of official affirmation of fulfillment. Of the employees interviewed, 52% state that methods are partially used, 12% indicate check sheets are used, 12% confirm the use of pre-delivery inspections and 12% state that multiple methods are used. However, 12% of the employees indicate that no methods are used.

On Eskom's employee views on the adequacy of final quality inspections, the phenomenological dimension of this study reveals that a substantially negative image of suppliers exists. A large group of employees (46%) considered supplier inspections to be inadequate, 46% state the inspections are not thorough and 5% state that no inspections are done. Only 3% state that inspections are complete and thorough.

5.7 Objective Four: Supplier Quality Control Measures

Some of the early pioneers of quality management afforded attention to quality control. Deming articulated the need for various "scales" of quality whereas Crosby focused on achieving "zero defect" (Summers 2009). According to Bamford & Forrester (2010), intrinsic to the definition of quality is an array of control measures such as testing procedures, statistical control methods, inspections and audits. Schroeder et al (2011) stated that quality appraisal costs incurred for inspections, checks, equipment calibration, laboratories and testing are critical for ensuring the company avoids internal and external failure costs.

5.7.1 Supplier Quality Control Improvement

According to Pycraft et al (2004), Deming advocated the concept of system

stability to reduce variation in product quality through quality control. Measurements are required throughout the organisation's systems and processes. System stability is achieved when measurements are monitored over time and yield a constant variance. Quality control is improved when variances are reduced. Krajewski et al (2006) stated that to prevent failure from occurring, organisations need to consistently improve their quality control methods.

A minority of suppliers "strongly agree" (4%) and "agree" (11%) that their quality control measures require no improvement. The "neutral" responses accounted for 32% which implies that almost a third of suppliers are unsure about whether quality control improvements are required. Majority of the suppliers (53%) state that their quality control measures require improvements. This acknowledgement indicates that suppliers are either constantly improving their quality controls or alternatively, recognise that there is room to improve their existing controls.

Eskom's employees interviewed on their perceptions of adequacy and frequency of supplier quality controls suggest that significant improvements are required to supplier quality controls. A small percentage (5%) considered that quality control exercised by suppliers is adequate. The rest of the Eskom employees indicate that supplier quality control is insufficient (41%), is only randomly applied (39%) and is non-existent (15%). The high percentage of Eskom employees who have expressed negative views on supplier quality control are in index of dissatisfaction with the level of supplier quality control. There is some degree of convergence between the quantitative and qualitative data on this question. Most of the suppliers state that their quality control requires improvement and the Eskom employees affirm this status quo by their substantially negative perception of supplier quality control measures.

5.7.2 Effectiveness of Supplier Quality Control

One of the approaches to quality management and control is the operations-based approach. Barnes (2008) stated that in this approach, quality is controlled in accordance with conformance to specification. This implies that the product or service quality evaluation is done in terms of the design intent. Slack et al (2004)

stated that quality control is only achieved when the product or service is deemed to be error-free.

Majority of the suppliers believe their quality control systems prevent defects from permeating onto Eskom's networks with 39% stating they "strongly agree" and 45% "agree" that their controls are effective. A small proportion of suppliers (11%) indicate "neutral" responses and 5% "disagreed" that their quality controls are effective.

How do Eskom's employees relate to the question of suppliers quality control effectiveness? The views of Eskom staff contrast sharply with the results of the suppliers responses. Majority of the Eskom employees (61%) state that supplier quality controls could be better executed, 17% are of the opinion that quality control is ineffective and a further 17% view supplier quality control as sporadic. Only a small proportion (5%) of employees consider quality controls to be effective.

5.7.3 Supplier Conformance to Specification

Kruger et al (2005) stated that one of the four absolutes in Crosby's definition of quality was conformance to specifications. This was part of his famous "zero defect" philosophy. According to Barnes (2008), the product-based approach to quality management has, as its cornerstone, an emphasis on product precision which implies the product is fully compliant with its specification. Slack et al (2004) stated that a quality gap will arise if there was an anomaly between a customer's specification of a product or service and that of an output from an organisation's operation. This could be argued as a reason for poor quality (Heizer & Render 2011).

Majority of the suppliers surveyed, "strongly agree" (56%) and "agree" (42%), that their products and services supplied to Eskom are in conformity with Eskom's specifications. A negligible minority of suppliers responded as "neutral" (1%) and "disagree" (1%). The quantitative data analysis shows a high level of confidence displayed by suppliers in their products and services conformance to Eskom

specifications. The phenomenological study indicates there is some degree of convergence with the views of Eskom employees with 61% percent of those interviewed indicating that Eskom's specifications are mostly adhered to. However, a quality gap may be observed where a significant minority of Eskom employees (35%) believe that Eskom's specifications are rarely met. This contrasts acutely with the quantitative data outcome where 98% of suppliers consider their products and services conform to Eskom's specification.

5.7.4 Identification and Rectification of Non-Conformances

When evaluating products and services in comparison with specifications, deviations from requirements are noted as non-conformances. Summers (2009) stated that Crosby viewed the price of non-conformance as one of the indices by which quality is measured. According to Kajewski et al (2010), non-conformances contribute towards internal and external failure costs of an operation.

The quantitative data analysis reveals that majority of the suppliers, "strongly agree" (26%) and "agree" (52%) that Eskom is satisfied with the timeous consistency of rectifying non-conformances. This implies that majority of the suppliers acknowledge incidents of internal and external failures within their operations but respond speedily in rectifying the failures. A significant minority of suppliers (21%) were "neutral" in their response which indicates doubts on their capabilities to adequately address non-conformances.

From an Eskom employee perspective, qualitative data gathered from interviews contrasted sharply with the position of suppliers with 78% of employees stating suppliers only respond to non-conformances when identified by Eskom. The inference is that there is little or no proactive involvement of suppliers in identifying non-conformances. In addition, 12% of employees indicated that suppliers rarely action non-conformances and 10% stated suppliers inconsistently identify non-conformances. None of the employees interviewed believe that suppliers have systems to identify non-conformances. There is clear discordance between the supplier's position on the management of non-conformance and the experience of Eskom employees.

5.7.5 Prevention Control of Repeat Non-conformance

Kruger et al (2005) stated that TQM requires every operational activity to be orientated towards customer satisfaction and creating value. To achieve this objective, there must be a systematic and methodical approach to correct defects and to prevent errors from re-occurring.

The quantitative data analysis indicated suppliers have a high degree of confidence in their systems to prevent the recurrence of non-conformances with 34% “strongly agree” and 52% “agree” responses. A small proportion of suppliers (13%) were “neutral” and a further 1% “disagree” that their systems prevent recurrence of non-conformances.

How does suppliers’ confidence in prevention controls measure-up against the backdrop of Eskom’s employees perceptions? In the phenomenological study, a stark contrast exists where 73% of Eskom employees interviewed report that supplier controls are insufficient and 5% believe that there are no non-conformance prevention controls. A small proportion of employees (20%) consider supplier controls to be good and 2% think suppliers have strict non-conformance controls. The qualitative data results highlight the discordance between suppliers’ confidence in their non-conformance prevention systems and the Eskom employees views thereof.

5.8 Objective 5: Impact of Supplier Quality Management on Technical Operations

Supplier’s products and services have a direct bearing on Eskom’s core technical operations viz. power network performance, maintenance, network operating costs, power network reliability and power interruption restoration times. All of Eskom’s power system apparatus is sourced from manufacturers and distributors. Services such as power system design, project management and network construction is mainly outsourced to engineering consultants and electrical contractors respectively. These service providers play a decisive role in the construction and commissioning of new power networks.

5.8.1 Effect on Network Performance Indices

Conjoining the response categories of “strongly agree” and “agree”, 69% of suppliers state that their quality management practices have improved Eskom’s power network performance. A significant proportion (31%) of suppliers returned “neutral” responses suggesting these suppliers are unaware of their products and services impact on Eskom’s network performance. Eskom employees are almost evenly divided on the manner of supplier’s quality management impacting upon Eskom’s network performance indices with 41% stating a slight improvement of performance has been achieved and 15% indicate a significant performance improvement has been achieved. A smaller (but significant) proportion of Eskom’s employees (29%) perceive suppliers as having a negative impact on Eskom and a further 15% indicate suppliers have no impact on Eskom’s performance.

5.8.2 Effect on Maintainability of Networks

The supplier responses indicate 28% of suppliers “strongly agree” and 50% “agree” that their quality management systems have enhanced maintainability of Eskom’s networks. Together, both response categories account for 78% of suppliers which reflects supplier confidence in improving network maintainability. However, 22% of suppliers indicate “neutral” responses suggesting that they are not able to determine the impact of their products and services on network maintainability. The quantitative data analysis indicates a clear supplier bias in favour of the positive impact of the quality management on network maintainability.

Eskom employees interviewed are almost evenly divided on the net effect of supplier quality management on maintainability of power networks. A slight majority (54%) of employees believe supplier quality management has no positive effect maintainability which includes 22% stating there is no effect on maintenance, 12% stating that maintenance frequencies have increased and 20% stating that more defects have been identified on networks. Those employees who believe that supplier quality management has made maintenance easier account for 17% of the interviewees and 29% state less maintenance is required after construction.

5.8.3 Effect on Operational Costs

The supplier responses to the survey questionnaire indicates 24% “strongly agree” and 48% “agree” their quality management systems have helped Eskom reduce operational costs whilst 28% returned “neutral” responses. The survey data reflects a high measure of confidence by suppliers in the contribution of their products and services in the reduction of Eskom’s operating costs.

How does supplier data on operating costs compare with perceptions of Eskom employees? A significant proportion of Eskom employees (44%) state that network maintenance costs have increased, a further 34% state that there is no impact on costs whilst 22% believe that maintenance costs have actually reduced. If the two response categories, employees who state operating cost has increased and those who state there is no impact on cost are summated, the majority view (78%) negates the suppliers’ position of operating cost reduction. There appears little correlation between the results of the quantitative and qualitative data where supplier’s responses contrast markedly with views of Eskom employees.

5.8.4 Effect on Network Reliability

Eskom’s network reliability is measured in terms of frequency of interruptions, faults on the power system and post-outage restoration times. Majority of Eskom’s suppliers affirmed that quality management of their products and services has helped Eskom improve its network reliability with 35% “strongly agree” and 49% “agree” responses. Only 16% of suppliers indicated “neutral” responses meaning that they are unable to make such a determination.

There is some degree of convergence between supplier’s responses and Eskom employees’ perceptions on the issue of network reliability. Of the Eskom employees interviewed, 20% state network reliability has become significantly better, 44% state it is slightly better, 22% state there is no effect on reliability and 14% of employees believe that network reliability has actually worsened. On network restoration times, 12% of Eskom employee’s state network reliability is significantly better, 34% state it is slightly better and 37% state there is no effect on network reliability. A small group of employees (15%) state network restoration

times have become slightly worse and 2% state it is significantly worse. Both the quantitative data analysis and the phenomenological study results show there is significant correlation between the supplier's responses and the views of Eskom employees on network reliability improvement.

5.8.5 Effect of Network Safety

Operational safety is a priority focus area for Eskom in view of electricity's potentially lethal characteristics more especially when quality management is compromised. Historically, many of Eskom's field operators and contractors have either been injured or fatally wounded as a direct consequence of working with and on electrical networks. The researcher considered it prudent to ascertain Eskom's supplier's commitment to safety of products and services. Quality is intrinsically linked to product safety and safe working procedures. The suppliers were almost unanimous in their response that their quality management systems are geared towards ensuring Eskom operates its networks in a safe manner. The responses indicate 52% of suppliers "strongly agree" and 43% "agree" that suppliers contribute to the safe operation of Eskom networks via quality management of their products and services with 5% of the suppliers who returned "neutral" responses.

5.9 Supplier Response on Technical Performance as a Function of Transaction History

The researcher sought to ascertain whether the historical length of time that suppliers transact with Eskom bears any influence on their response selection to the quality management impact on operational performance. Suppliers were categorised into two groups i.e. the first group were those suppliers who've transacted with Eskom for less than 10 years and the second group were those who did so for more than 10 years. The suppliers were almost evenly divided in the two categories with 39 and 43 suppliers who transacted with Eskom for less and more than 10 years respectively. There was an appreciable difference (more than 10%) in responses of those suppliers who've transacted with Eskom for longer than 10 years where they state that network maintainability is improved,

network operating costs are reduced, reliability and safety is enhanced. These suppliers display a higher degree of certainty and confidence in the selection of their responses.

5.10 Supplier Response on Technical Performance as a Function of ISO Accreditation

The data analysis of the supplier sample showed 24% are ISO 9000 accredited and 76% are non-accredited. The supplier responses reflect an appreciable difference (greater than 10%) between ISO 9000 accredited and non-accredited suppliers in respect of improving operational performance, maintainability and operational cost reduction where ISO 9000 accredited suppliers display significantly greater confidence levels in their selection of affirmative responses. The differences between ISO accredited and non-accredited suppliers on network reliability and safety is not significant as both categories have responded similarly.

5.11 Summary

The discussion on the results from the multi-method research approach highlights areas of convergence and divergence between suppliers and Eskom's employees on fundamental elements of this study. The responses of suppliers, which formed the essence of the quantitative data analysis and the structured interviews conducted with Eskom employees that was the key to the phenomenological dimension, provides a composite understanding of the aim and objectives of the research study. The supplier responses are not discussed in a vacuum but contextualised within the lived experiences of Eskom's employees.

For an understanding of TQM, Eskom's suppliers are mostly in agreement on the key concepts of the need for a quality management policy, staff knowledge of quality, optimisation of quality costs and improvement of productivity. Eskom's employees are unanimous in their acknowledgement of the crucial role of TQM in the sustainability of network operations.

On supplier commitment to quality management, a quality gaps exists between

suppliers and Eskom staff on visible involvement of supplier top management as well as for competency levels of supplier staff. Eskom's employee perceptions do not concur with the favourable assessments of suppliers. However, there is convergence between supplier's responses and Eskom employee perceptions of continual improvement, the need for quality procedures for products and services and internal organisational reviews.

Whilst suppliers positively affirmed their desire for customer satisfaction through their feedback systems and confirmation of Eskom's requirements, a substantially negative image is prevalent amongst Eskom employees on supplier commitment to customer satisfaction, effective communication from supplier and fulfillment of Eskom's power network requirements.

Quality control measures implemented by suppliers highlighted correlation between suppliers and Eskom's employees on product and service conformance to Eskom's specifications. However, there was significant divergence in the views of suppliers and Eskom employees on the issues of improving quality controls, defects permeating onto Eskom's networks and management of non-conformances. Eskom employees do not share the confidence expressed by suppliers on some elements of their quality control measures.

The impact of supplier quality management on technical performance did not yield any special trend except for operational costs where there was significant divergence between suppliers and Eskom employees. Whilst suppliers indicate their quality management has enabled Eskom to reduce its operational and maintenance costs, Eskom's employee's state otherwise. On performance indices, maintainability, network reliability and safety, suppliers positively affirm their impact on Eskom's operations. However, Eskom employees appear evenly divided on the impact of supplier quality management on these aspects.

Supplier response to questions on impact of quality management of technical operations is influenced by ISO 9000 accreditation and length of transaction history between supplier and Eskom. In both cases it is observed that suppliers who are ISO accredited and have a transaction history of longer than 10 years are

appreciably more decisive in their selection of positive responses.

The discussion of the data analysis is followed in the next chapter by a conclusion to the study and also includes recommendations substantiated by the data gathered, findings, limitations of the study and suggestions for further research.

CHAPTER 6

RECOMMENDATIONS AND CONCLUSIONS

6.1 Introduction

The research study has highlighted interesting dimensions of the relationship between suppliers and Eskom in respect of the impact of quality management on Eskom's power network operations. Whilst quantitative data is useful in understanding suppliers approach to a range of quality management concepts and application thereof within their respective organisations, the phenomenological aspect of the study serves as an index of Eskom's employee's perceptions of supplier quality management. Supplier quality management is better understood within the context of Eskom's employee's experience and enables a more holistic understanding of the research problem. The multi-method research approach adopted for this research study is vindicated by the comprehensive nature of the results achieved.

The early pioneers of quality management, notably Feigenbaum, Juran, Deming, Crosby and Ishikawa among others, played a pivotal role in establishing the paradigm for the evolution and implementation of quality systems in modern organisations. The foundation of quality management, as understood in modern organisations, is based on the historic conceptualisation of quality in terms of total quality control, the zero defect philosophy, process system stability, control techniques, quality planning, system improvements and employee engagement in achieving quality objectives as espoused by the quality pioneers. Internationally, quality management bodies such as AQS, CQI and ISO, formulated many quality philosophies, policies and procedures through synthesis and adaptation of work done by the quality pioneers.

This research study is premised on concepts of quality in relation to operations management. Thus the focus of the study is on TQM, supplier commitment to quality management, focus on customer satisfaction, supplier quality control measures and supplier quality impact on Eskom's operations. Some of the key

elements that circumscribe the TQM philosophy included in this study are the need for officially documented quality policies, staff involvement in meeting quality objectives and cost of quality optimisation. For supplier commitment to quality, the researcher explores top management visibility, continual improvement, quality procedures for products, staff competence and internal reviews of products and services. Many definitions of quality position the customer at the apex of quality management strategies. Customer satisfaction is thus considered in this study as a business objective, integral to effective communication about quality and the establishment of customer feedback channels between supplier and customer. Quality control is exercised by suppliers using various techniques, enforcing compliance to specifications and swift remedial action for identified non-conformances. Finally, this study delves into the effect of supplier quality management on Eskom's technical operations in respect of network performance, reliability, maintainability, safety and maintenance cost reduction.

6.2 Research Objectives

The first objective was to ascertain the understanding of TQM application within supplier's organisations. TQM is an operations philosophy which requires every level, process, system and employee to achieve the organisation's quality objectives. The reference point for an organisation's commitment to quality is the official adoption of a quality management policy which governs and encompasses the entire operation. The study revealed that 95% of the suppliers subscribe to the idea of a documented quality policy for their respective organisations. Suppliers are aware of the importance of an overarching quality policy which prescribes the manner in which quality objectives are to be achieved within their respective organisations. Supplier responses affirm the influence of their quality policy as 90% of the suppliers state that their employees are imbued with the requisite knowledge of quality management.

Majority of the suppliers (79%) indicate they have optimised the cost of investment in techniques to control quality versus the cost of internal and/or external failure. This reflects a determination on the part of the suppliers to minimise the risk of product or service failure. However 21% of suppliers, who were unable to

definitively commit to quality cost optimisation, represent a substantial risk of quality failure for Eskom's operations. This is signified by 52% of suppliers who acknowledge they have experienced failures with their products and services. Most of the suppliers (94%) provided a favourable assessment of enhanced productivity and efficiency derived from application of TQM principles in their respective organisations.

In the phenomenological dimension of the study, 88% of Eskom employees interviewed emphasised the critical importance of TQM whilst the remainder of the employees consider TQM to be either very important or critical for the sustainability of Eskom's operations. Both Eskom's employees and suppliers are in general agreement about the need for and importance of the application of TQM principles in the provision of products and services.

The second objective of this study was to understand supplier's commitment to quality management of their products and services provided to Eskom. An organisation's success in implementing quality strategies hinges upon the support of top management. The analysis shows that 99% of supplier's top management personnel are visibly committed to quality requirements. However, a quality gap exists in that this perception of top management visibility is not shared by Eskom's employees. Only 10% of Eskom's employees consider suppliers top management personnel to be fully committed. This represents a potential source of concern for the supplier's customer relationship management strategies. On continual improvement strategies, 99% of suppliers are in agreement with the implementation of continual improvement. To the supplier's credit, most of Eskom's employees recognise the suppliers' efforts to institute continual improvement in the provision of products and services. It is an element of quality management which is positively managed by suppliers. The majority of the suppliers (94%) have implemented quality procedures for their products and services. All Eskom employees interviewed considered quality procedures to be important. From the interviews, it is evident that Eskom employees support the need for suppliers to have documented quality management procedures. For the improvement of power network performance, 49% of Eskom's employees considered documented quality management procedures important whilst 51%

indicated it helps with building high quality networks. None of Eskom's employees considered quality procedures as unimportant or without impact on network quality. Both, suppliers and Eskom's employees, are in agreement that documented quality procedures are crucial to operations.

Together with documented quality policies, supplier's staff skill and competence enhance product and service quality. The majority of suppliers (94%) consider their staff to be fully capable of meeting Eskom's quality criteria. The interviews with Eskom's employees reveal the prevalence of a contrasting view to that of the supplier's survey results. None of the Eskom employees interviewed consider supplier staff to be highly skilled, with 64% of those interviewed believe that suppliers' staff are competent but in need of ongoing training and a further 34% express the view that supplier staff have low competence levels. This divergence may be attributed to the gap between customer perceptions versus supplier's definition of quality and/or suppliers external failure costs which are sub-optimal.

The third objective of this study is to understand the level of customer focus on the part of suppliers and Eskom's employees' experience of customer satisfaction. Most of the suppliers (97%) state that the main goal of their operations is to achieve customer satisfaction. The perceptions of only a small minority (10%) of Eskom's employees concur with the suppliers stated aim on customer satisfaction. This indicates that there is a fundamental mismatch between the supplier's goal of achieving customer satisfaction and Eskom's employees' experience of customer satisfaction. One of the reasons that may explain this mismatch is the response to the question of effective communication about quality. Whereas 97% of suppliers consider their communication on quality with Eskom to be effective, only 34% of Eskom employees express the view that communication is satisfactory. Effective communication from suppliers to Eskom does not appear to be at an acceptable level. Most suppliers seem to have placed a preponderant emphasis on and invested confidence in their verification of Eskom's quality requirements as a substitute to effective communication with Eskom about quality. Most suppliers indicate they receive feedback from Eskom about product and service quality. However, there is a significant proportion of suppliers (31%) who are either unsure or do not receive feedback from Eskom on quality. These suppliers are unable to

assess the level of customer satisfaction and may be considered a contributing factor to the poor level of customer satisfaction expressed by Eskom's employees.

A high percentage of suppliers (92%) of suppliers believe that they have institutional mechanisms to determine whether or not Eskom's requirements are adequately met. This is validated in the views expressed by most of Eskom's employees who state that suppliers have mechanisms, applied in varying degrees, to determine whether quality requirements are met.

Based on the findings, it is apparent that there exists a significant chasm between suppliers and Eskom's employees on some of the key dimensions of quality in respect of products and services. Confidence in customer satisfaction, as articulated by the supplier's responses, is not congruent to the perception of Eskom's employees.

The fourth objective focused on the efficacy of supplier's quality control measures. Much of the previously stated early pioneers work on quality management in operations was devoted to quality control techniques. In this study, only a small proportion of suppliers (15%) state their quality controls do not require improvement while majority of suppliers consider their controls as needing enhancement. This means that most suppliers are improving their controls or acknowledge that there is space for improvement. Eskom's employee's perceptions on adequacy and frequency of supplier quality controls suggest that significant improvements are required to supplier quality controls. The high percentage of Eskom employees who express negative views on supplier quality control are in index of the extent of dissatisfaction with supplier quality control. On the question of quality control effectiveness, most suppliers express confidence in their defect-prevention methods. This is in sharp contrast with Eskom's employee's views, most of whom perceive supplier quality controls to be ineffective.

Most suppliers (98%) consider the quality of their products and services to be in accordance with Eskom's specifications. The phenomenological study indicates some degree of convergence with the views of most of Eskom's employees

consider Eskom's specifications are mostly adhered to. However, a disturbing proportion of Eskom employees (35%) believe that Eskom's specifications are rarely met. In cases where non-conformances to specifications are identified by Eskom's personnel, most of the suppliers state that Eskom is satisfied with timeous resolution thereof. Tested against the backdrop of Eskom's employees' perceptions of non-conformance management, suppliers are not seen to proactively prevent or resolve defects. Supplier's responses to non-conformances may be characterised as reactive interventions.

From an Eskom employee perspective, qualitative data gathered from interviews contrasted sharply with the position of suppliers with 78% of employees stating suppliers only respond to non-conformances when identified by Eskom. The implication is that there is little or no proactive involvement of suppliers in identifying non-conformances. In addition, 12% of employees indicated that suppliers rarely action non-conformances and 10% stated suppliers inconsistently identify non-conformances. None of the employees interviewed believe that suppliers have systems to identify non-conformances. There is clear discordance between the supplier's position on the management of non-conformance and the experience of Eskom employees. On prevention of recurrent non-conformances, the study reveals a similar pattern of discord between supplier's responses and Eskom's employees' perceptions. The mechanisms deployed by suppliers to manage non-conformances don't appear to be effectively resolving defects.

The fifth objective of this study was to probe the impact of supplier quality management on key performance indices of Eskom's network operations. Eskom's Distribution Division is contracted to ensure that its power network operations perform reliably, safely and optimally within budgeted cost. Slightly over two thirds of the supplier's state that the quality of their products and services impact positively on Eskom's network performance. A significant proportion of suppliers are unable to determine the net impact of their products and services on Eskom's network performance. Eskom's employees express mixed views on supplier impact on network performance with just over 50% of interviewees stating there is a slight to significant improvement. The rest of the interviewees indicate there is either no impact or negative impact on performance indices.

The majority of the suppliers indicate that network maintainability is enhanced by their products and services. Interviews with Eskom's employees suggest their perceptions are almost evenly divided on whether network maintainability is enhanced by suppliers. A slight majority (54%) indicate that there is either no effect or a negative effect by suppliers on maintainability whilst the rest believe enhancements have been made. A contrasting picture emerges on network operational maintenance cost reduction where the majority of suppliers state that maintenance costs have effectively been reduced. From the Eskom's employees interviewed, only 22% believe maintenance costs have reduced.

This research study indicated that suppliers have a favourable view of their products and services impact on network reliability. There is a modest degree of convergence and validation of this statement with the views expressed by Eskom's employees. An overwhelming majority of the suppliers state that their quality management systems support Eskom's safe network operations policies.

6.3 Has the Research Problem been Addressed?

The primary focus of this research study is to develop an understanding of the impact of supplier quality management on Eskom's network operations. Quality management, as applied to business operations, is comprised of a complex web of intra and supra organisational interfaces and dependencies. Quality management is an organisation-wide strategic approach to business operations and is underpinned by multiple facets, which, when synergistically aligned, produces the desired outcome.

In order to interrogate the primary research problem, the researcher explored the multiple dimensions of quality management and thematically segmented these into TQM, supplier's commitment to quality management, customer focus and satisfaction, quality control and network performance impact. Each of the aforementioned themes was further subdivided into the multitude of concepts that comprise quality management. By analysing the responses of suppliers to the sub-themes of quality management, the researcher attempts to develop a composite

understanding of the overall aim of the study.

To achieve the overall aim of this research study, the researcher sought to probe the depth of understanding amongst suppliers of fundamental quality management concepts and weighed this against the backdrop of the phenomenological dimension of Eskom's employee's experiences. Towards this end, the researcher is confident that the principal aim of the study was largely and substantively achieved through use of the multi-methods approach i.e. quantitative and qualitative research techniques.

6.4 Limitations of this Research Study

This study has several limitations which influence the specific line of inquiry and approach to the research problem. Eskom is a nationally based parastatal organisation with many corporate divisions. The study scope does not purport to encompass all of Eskom's corporate divisions. In selecting the title of the research study, the parameters of this study were circumscribed by geographic and company divisional considerations. The study focused on Eskom's Eastern Region, a part of its Distribution Division, located in the province of KwaZulu Natal. In view of time constraints, the research scope excluded the interrogation of Eskom's technical performance database to evaluate specific instances of adverse or positive effects of supplier quality management. Likewise, Eskom's non-conformance database was also excluded from this study.

Eskom's Eastern Region has a list of 839 suppliers providing an extensive range of products and services. For the quantitative dimension of the study, the supplier population for participation in this study was restricted only to those suppliers who impacted the Region's network operations. In addition, the researcher introduced a further refinement in the selection of suppliers using the criterion of transaction value. The study focused on those suppliers who constitute about 70% of the total transaction value with Eskom's Eastern Region. These comprised a total of 187 suppliers which formed the sample of this study.

The researcher was able to recover 82 completed questionnaires from the 187

suppliers contacted to participate in the study. This sample comprised of 44% of the identified study population. Supplier's locations are dispersed predominantly in KwaZulu-Natal with some suppliers in other provinces. Due to time constraints and the dispersion of suppliers, it was not practical to administer face-to-face questionnaires. This can pose a challenge in cases where suppliers may require clarification on queries relating to the questionnaire. However, this eventuality was compensated for by adopting the Likert approach to questionnaire design whereby the respondent is limited to specific choices. This approach minimises the room for error or incorrect interpretation of the questions.

For the phenomenological dimension of this study, the selection of interviewees did not involve the participation of all Eskom's employees deployed within its engineering and supply chain management departments. The choice of Eskom's participants was limited only to 41 employees who are employed within its network operations section. The structured interviews were administered via email and through telephonic contact as the research participants are dispersed throughout KwaZulu-Natal. Personal contact would have been the preferred method of interviewing employees; however, it would have been logistically onerous and inordinately time-consuming.

6.5 Implications of this Research Study

A research study of this nature and magnitude has previously never been conducted within Eskom. There was no pre-existing body of knowledge on this particular research problem and thus this study serves as a benchmark for future studies related to supplier quality management within the electricity supply industry. The most important contribution of this study is that the data gathered as part of this research endeavour, has created space for the study of quality management dynamics between suppliers and Eskom's network operations.

Eskom is a strategic national asset which plays a vital role in the social and economic development of this country. As a parastatal, it has a formidable asset base with a multi-billion rand expenditure budget for its capital expansion and maintenance operations. There are large inflows and outflows of capital from

financial institutions and to suppliers respectively. The nature of its product – production and distribution of electricity – is potentially hazardous to its users and requires application of the highest levels of safety and quality to be effectively distributed throughout the country. As a result, suppliers are expected to ensure that the integrity of their quality management strategies fully meet (or even exceed) Eskom's specified requirements.

The researcher highlights several hitherto unknown dimensions of supplier quality management impact on Eskom's network operations. In addition, this research study points to a few discrete elements of quality management which suppliers may utilise to firstly, consolidate those elements of quality management which are successfully expedited and secondly, commit to improving other aspects where there are obviously negative consequences. Eskom's suppliers may use the research outcome to identify possible lapses or gaps in their quality management systems to improve their performance at those levels. By so doing, it would enable suppliers to re-configure their business operational procedures and strategies to improve quality management in relation to those areas that are negatively impacting Eskom's network operations.

6.6 Recommendations for Future Studies

As indicated in Section 6.5, this research study is to some degree, pioneering in nature in that it is not an extension of existing knowledge on the topic. There are several recommendations for future research studies in the field of supplier quality management within the electricity supply industry. If municipal electricity undertakings are grouped together with Eskom as an industry sector, they form a formidable unit impacting the South African economy. This research study may be used as a basis to study general and specific aspects of supplier quality management impact on the greater electricity supply industry.

Recommendations for future studies are as follows:

- A study similar to this research project may be initiated in another division of Eskom eg. Generation or Transmission Divisions, to ascertain if comparable outcomes are derived. Alternatively, a study

could be undertaken in one or more of the municipal electricity undertakings to determine if there are similar discernable institutionalised traits in supplier quality management. Conclusions may thereafter be drawn about supplier quality management strategies in the wider electricity industry;

- For analysis purposes in this study, consulting engineering companies, electrical engineering companies and product manufacturers were combined into one supplier group. A future study should disaggregate these supplier categories and research the direct quality management impact of each supplier category on targeted facets of Eskom's operations. The aim of this study should be to identify the existence of differentiated impact of supplier categories on Eskom;
- A study may be undertaken into the variation in supplier quality management policies on the basis of ISO accreditation. A more thorough and detailed analysis should be conducted to determine the effect of ISO accreditation on supplier quality. Pending the outcome of such a research study, Eskom would be better informed on whether or not ISO accreditation should be a pre-condition for all its suppliers;
- A phenomenological study should be considered to compare the responses of Eskom's employees to supplier quality management of those who are employed within its engineering department with that of employees within the supply chain environment. The aim of such a study could potentially highlight anomalies within Eskom's employees relationships with suppliers;
- A focused study may be initiated into analysing the performance of newly constructed power networks with the performance of older established networks. Power utilities maintain elaborate databases of information relating to power network performance and this could be used as a basis for such a study. A study of this nature would highlight possible effects of quality management in mediating the attainment of Eskom's power network reliability and performance objectives;

The abovementioned areas are recommendations for possible future research studies that could expand upon the knowledge gained from this research study.

6.7 Summary

Supplier quality management poses certain challenges for the long term sustainability of Eskom's network operations. The solutions to the problems identified in the study may not be easily attainable but the challenges are by no means insurmountable. Suppliers need to review their quality management culture in a holistic manner and conduct an introspective evaluation of the effectiveness of their quality programmes. A concerted attempt is required from suppliers to concentrate their resources on those aspects which are presently considered as having an unfavourable impact on Eskom's operations. Notably, the quality management challenges were accentuated by the diametrically opposed positions of suppliers and Eskom's employees. These issues are substantive enough to warrant rigorous analysis on the causal factors thereof. Fundamentally, the stated quality management intention of suppliers does not seamlessly translate into favourable perceptions amongst Eskom's employees. This indicates that there are serious lapses and gaps in product and service delivery. The complexities associated with managing a large number of suppliers with significant variability in their quality management programmes in an intensely sophisticated technology industry is not without its share of problems. The areas of quality management that are in need of attention by suppliers are:

- On TQM, it is evident that suppliers have not optimised the cost of quality in their operations. Suppliers are reliant upon Eskom to identify defects on products, poor quality workmanship and mismanaged service delivery. This creates an administrative overhead burden for Eskom and consumes supplier resources unnecessarily. Indirect costs of external failure gradually and systematically erodes customer confidence. A possible solution would be for suppliers to re-evaluate their investment in prevention and appraisal costs;
- Supplier commitment to quality management is not visibly demonstrated to the satisfaction of Eskom's employees. The difference between high performing companies and those that are not, is often determined by their willingness and readiness to engage with customers. Suppliers may be lulled into complacency on the notion that product or service quality may be

sufficient as a substitute for demonstrably visible supplier-customer relationship building. Greater investment in staff skill improvement initiatives and competency enhancement is also a critical element that would enable suppliers to intensify their commitment to quality management;

- Customer satisfaction is often referred to in literature as the defining index of quality. This is a dimension of quality management that suppliers consider as a high priority in their operations but the perception amongst Eskom's employees conveys a predominantly unfavourable verdict. Suppliers need to re-orientate their respective business operations with a more customer-centric bias to achieve a turnaround in the present adverse perception of product and service delivery. A possible solution to this is for suppliers to establish and improve channels of communication with Eskom. It requires creative thinking on how to invigorate communication about product and service delivery;
- Quality control is a measurable dimension of quality management where a turnaround in performance may be achieved relatively swiftly within a defined period. The starting point for suppliers would be the full compliance with Eskom's specifications. Commendably, whilst most suppliers adhere to Eskom's specifications, the final end-product delivery is compromised by lapses in quality control.

BIBLIOGRAPHY

Allen, K. 2005. *Explaining Cronbach's Alpha*. Available WWW: <https://engineering.purdue.edu/.../Cronbach%20Alpha.p> (Accessed 30 November 2011).

Bamford, D., & Forrester, P. 2010. *Essential Guide to Operations Management – Concepts and Case Notes*. John Wiley & Sons, Ltd., Sussex.

Barnes, D. 2008. *Operations Management – An International Perspective*. Thomson Learning, London.

Basic Concepts. 2011. [Online]. Available WWW: <http://asq.org/glossary/q.html> (Accessed 31 July 2011).

Besterfield, D.H. 2008. *Quality Control*. 8th Ed. Prentice Hall, New Jersey.

Blaxter, L., Hughs, C., & Tight, M. 2006. *How to Research*. Open University Press, Berkshire.

Blumberg, B., Cooper, D.R., & Schindler, P.S. 2005. *Business Research Methods*. McGraw Hill Education, Berkshire.

Bruin, J. 2006. Newtest – Command to compute new test. *UCLA: Academic Technology Services, Statistical Consulting Group*. Available WWW: <http://www.ats.ucla.edu/stat/stata/ado/analysis/>. (Accessed 1 December 2011).

Bryman, A., & Bell, E. 2007. *Business Research Methods*. 2nd Ed. Oxford University Press, Oxford.

Bryman, A. & Cramer, D. 2006. *Quantitative Data Analysis with SPSS 12 and 13 – A Guide for Social Scientists*. Routledge, New York.

Byrne, M.M. 2001. Understanding life experiences through a phenomenological approach to research. *AORN Journal*, Vol 73, No. 4. [Online]. Available WWW: http://findarticles.com/p/articles/mi_m0FSL/is_4_73/ai_73308177/ (Accessed 7 July 2011).

Chase, R.B., Jacobs, F.R., & Aquilano, N.J. 2006. *Operations Management for Competitive Advantage*. 11th Ed. McGraw-Hill Irwin, New York.

Cresswell, J.W. 2007. *Qualitative Inquiry & Research Design – Choosing Among Five Approaches*. 2nd Ed. Sage Publications, California.

Dale, B.G. 2008. *Managing Quality*. 5th Ed. Wiley Blackwell Publishers, New Jersey.

Dale, B.G., & Cooper, C. 1992. *Total Quality and Human Resources – An Executive Guide*. Oxford, Blackwell.

Eskom Company Profile. 2011. [Online]. Available WWW:
<http://www.eskom.co.za/c/40/company-information/> (Accessed 15 October 2011).

Evans, J.R. 2007. *The Management and Control of Quality*. 6th Ed. Thomson, Ohio.

Finlay, L. 2008. An Introduction to Phenomenology. [Online]. Available WWW:
www.lindafinlay.co.uk/ (Accessed 10 July 2011).

Flynn, B.B., Schroeder, R.G., & Sakakibara, S. 1995. The Impact of Quality Management Practices on Performance and Competitive Advantage. *The CEI Interactive Business Network*. [Online] Available WWW:
http://findarticles.com/p/articles/mi_qa3713/is_199509/ai_n8728362/ (Accessed 13 June 2011).

Garvin, D. 1988. *Managing Quality*. Free Press, New York.

George, D., & Mallery, P. 2003. *SPSS for Windows Step by Step – A Simple Guide and Reference*. 11.0 update. 4th Ed. Allyn & Bacon, Boston.

Gliem, J.A., & Gliem R.R. 2003. Calculating, Interpreting and Reporting Cronbach's Alpha Reliability Coefficient for Likert-Type Scales. *Midwest Research-to-Practice Conference in Adult, Continuing, and Community Education*. Available WWW: <https://scholarworks.iupui.edu/bitstream/handle/1805/344/Gliem%20&%20Gliem.pdf> (Accessed 10 December 2011).

Goddard, W., & Mellville, S. 2006. *Research Methodology – An Introduction*. 2nd Ed. Juta, CapeTown.

Heizer, J., & Render, B. 2011. *Operations Management*. 10th Ed. Pearson Education, New Jersey.

History of Quality. 2011. [Online]. Available WWW: <http://asq.org/learn-about-quality/history-of-quality/overview/overview.html> (Accessed 8 August 2011).

Hoyle, D. 2010. *ISO 9000 – Quality Systems Handbook*. 6th Ed. Elsevier, Oxford.

Hur, M.H. 2009. The Influence of Total Quality Management Practices on the Transformation of How Organisations Work. *Total Quality Management & Business Excellence*, Vol. 20, No.8. [Online]. Available WWW: <http://asq.org/glossary/q.html> (Accessed 23 August 2011).

ISO 9000 Essentials. 2000. [Online]. Available WWW: http://www.iso.org/iso/iso_9000_essentials (Accessed 29 June 2011).

Keller, G. 2006. *Statistics for Management and Economics*. 7th Ed. Thomson Higher Education, California.

Krajewski, L.J., Ritzman, L.P., & Malhotra, M.K. 2010. *Operations Management – Processes and Supply Chains*. 9th Ed. Pearson Education, New Jersey.

Kruger, D., De Wit, P., & Ramdass, K. 2005. *Operations Management*. Oxford University Press, Cape Town.

Lakhal, L., Pasin, F., & Limam, M. 2006. Quality Management Practices and their Impact on Performance. *International Journal of Quality & Reliability Management*, Vol. 23, No. 6. [Online]. Available WWW: <http://www.emeraldinsight.com/journals.htm?articleid=1562387> (Accessed 22 June 2011).

Lancaster, G. 2005. *Research Methods in Management – A Concise Introduction to Research in Management and Business Consultancy*. Elsevier Butterworth-Heinemann, Oxford.

Leedy, P.D., & Ormrod, J.E. 2005. *Practical Research – Planning and Design*. 8th Ed. Pearson Education, New Jersey.

Likert Scaling. 2006. [Online] Available WWW: <http://www.socialresearchmethods.net/kb/scallik.php> (Accessed 17 June 2011).

Lind, D.A., Marchal, W.G., & Wathen, S. A. 2005. *Statistical Techniques in Business & Economics*. 12th Ed. McGraw Hill Irwin, New York.

Markusic, M. 2011. Simplifying the Likert Scale. The Bright Hub Education. [Online] Available WWW: <http://www.brighthubeducation.com/special-ed-law/13507-likert-scale-questionnaire-format-and-sample-questions/> (Accessed 17 June 2011).

Montgomery, D. 2008. *Introduction to Statistical Quality Control*. 6th Ed. John Wiley & Sons, New York.

Muhlemann, A., Oakland, J. & Lockyer, K. 1992. *Production and Operations Management*. 6th Ed. Pitman Publishing, London.

Murray, R. 2006. *How to write a thesis*. 2nd Ed. Open University Press, New York.

Naylor, J. 2002. *Introduction to Operations Management*. 2nd Ed. Pearson Education, Ltd., Essex.

Neumann, W.L. 2011. *Social Research Methods – Qualitative and Quantitative Approaches*. 7th Ed. Pearson Education, Boston.

New Build Programme. 2011. [Online] Available WWW:

<http://www.eskom.co.za/c/article/53/new-build-programme/> (Accessed 15 October 2011).

Oakland, J.S. 1993. *Total Quality Management – The Route to Improving Performance*. 2nd Ed. Butterworth-Heinemann, London.

Parasuraman, A., Zeithaml, V.A., & Berry, L.L. 1985. A Conceptual Model of Service Quality and its Implications for Future Research. *Journal of Marketing*, Vol. 49, No.4, pp 41 – 50. American Marketing Association, Birmingham.

Pycraft, M., Singh, H., Phihlela, K., Slack, N., Chambers, S., Harland, C., Harrison, A., & Johnston, R. 2004. *Operations Management*. Pearson Education, Cape Town.

Quality management principles. 2008. [Online]. Available WWW:

http://www.iso.org/iso/iso_catalogue/management_and_leadership_standards/quality_management/gmp.htm (Accessed 6 August 2011).

Reynaldo, J., & Santos. A. 1999. Cronbach's Alpha – A Tool for Assessing the Reliability of Scales. *Journal of Extension*, Vol. 37. No. 2. Available WWW: <http://www.joe.org/joe/1999april/tt3.php>. (Accessed 24 November 2011).

Saunders, M., Lewis, P., & Thornhill, A., 2007. *Research Methods for Business Students*. 4th Ed. Pearson Education Ltd, Essex.

Schroeder, R.G., Meyer Goldstein, S., & Rungtusanatham, M.J. 2011. *Operations Management – Contemporary Concepts and Cases*. 5th Ed. McGraw Hill, New York.

Sekaran, U., & Bougie, R. 2010. *Research Methods for Business – A skill-Building Approach*. 5th Ed. John Wiley & Sons, Sussex.

Slack, N., Chambers, S., & Johnston, R. 2004. *Operations Management*. 4th Ed. Pearson Education Limited, Essex.

Smith, D.W. 2011. Phenomenology. *The Stanford Encyclopedia of Philosophy* [Online]. Available WWW: <http://plato.stanford.edu/archives/fall2011/entries/phenomenology/> (Accessed 14 December 2011).

Stevenson, W.J. 2002. *Operations Management*. 7th Ed. McGraw Hill, New York.

Straker, D. 2001. *What is Quality?* [Online]. Available WWW: http://syque.com/articles/what_is_quality/what_is_quality_4.htm (Accessed 1 July 2011).

Sukdeo, N. 2009. *The Importance of Integrating Quality Practices into Strategic Management*. Durban University of Technology, Durban.

Summers, D.C.S. 2009. *Quality Management – Creating and Sustaining Organizational Effectiveness*. 2nd Ed. Pearson Education, New Jersey.

Waters, J. 2010. Phenomenological Research. [Online]. Available WWW: <http://www2.capilanou.ca/programs/psychology/students/research/phenom.html> (Accessed 19 June 2011).

Ways of Approaching Research – Qualitative Designs. 1999. Available WWW: <http://www.fortunecity.com/greenfield/grizzly/432/rra3.htm#phenomenology> (Accessed 6 June 2011).

What is Quality? 2011. [Online]. Available WWW: www.thecqi.org/Knowledge-Hub/What-is-quality/ (Accessed 31 July 2011).

Wilkinson, A., Redman, T., Snape, E., & Marchington, M. 1998. *Managing with Total Quality Management – Theory and Practice*. Macmillan Press, London.

APPENDICES

Appendix A- Ethical Clearance



UNIVERSITY OF
KWAZULU-NATAL
INYUVESI
YAKWAZULU-NATALI

Research Office, Govan Mbeki Centre
Westville Campus
Private Bag x54001
DURBAN, 4000
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mohunp@ukzn.ac.za

17 June 2011

Mr RM Asmal (200297102)
Graduate School of Business
Faculty of Management Studies
Westville Campus

Dear Mr Asmal

PROTOCOL REFERENCE NUMBER: HSS/0324/011M
PROJECT TITLE: The impact of supplier Quality Management on Eskom's Eastern Region Power Network Operations

In response to your application dated 13 June 2011, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and the protocol has been granted **FULL APPROVAL**.

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment /modification prior to its implementation. In case you have further queries, please quote the above reference number.

PLEASE NOTE: Research data should be securely stored in the school/department for a period of 5 years.

I take this opportunity of wishing you everything of the best with your study.

Yours faithfully


.....
Professor Steven Collings (Chair)
HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS COMMITTEE

cc. Supervisor: Mr D McCabe
cc. Mrs Christel Haddon



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Appendix B- Informed Consent Letter 3C

Informed Consent Letter 3C

UNIVERSITY OF KWAZULU-NATAL
SCHOOL

Dear Respondent,

MBA Research Project

Researcher: Riaz Asmal (071 892 3085)

Supervisor: Danny McCabe (0825678998)

Research Office: Ms P Ximba 031-2603587

I, **Riaz Mehmood Asmal**, an MBA student, at the Graduate School of Business, of the University of Kwazulu Natal. You are invited to participate in a research project entitled ***Impact of Supplier Quality Management on Eskom's Eastern Region Power Network Operations***. The aim of this study is to: determine the effectiveness of quality management systems applicable to Eskom's supply chain management processes where goods and services are procured from external commodity suppliers and service providers and to assess the impact on power network reliability.

Through your participation I hope to understand the effectiveness of quality management of goods and services procured through Eskom Eastern Region's supply chain process and the impact on its capital expansion programme and field operations. The results of the focus group are intended to contribute to an evaluation of the existing quality management criteria applicable to the procurement of goods and services, an understanding of the relationship between quality management and power network reliability and potential enhancements in quality management systems in respect of supply chain processes.

Your participation in this project is voluntary. You may refuse to participate or withdraw from the project at any time with no negative consequence. There will be no monetary gain from participating in this survey/focus group. Confidentiality and anonymity of records identifying you as a participant will be maintained by the Graduate School of Business, UKZN.

If you have any questions or concerns about completing the questionnaire or about participating in this study, you may contact me or my supervisor at the numbers listed above.

The survey should take you about **15** minutes to complete. I hope you will take the time to complete this survey.

Sincerely

Investigator's

Date_____

signature_____

This page is to be retained by participant

**UNIVERSITY OF KWAZULU-NATAL
SCHOOL**

MBA Research Project
Researcher: Riaz Asmal (071 892 3085)
Supervisor: Danny McCabe (082 567 8998)
Research Office: Ms P Ximba 031-2603587

**NB. KINDLY SIGN FILL IN YOUR NAME IN THE SPACE PROVIDED AND FAX
TO RIAZ ASMAL – 0866 929 137 OR EMAIL TO ME ON
ASMALR@ESKOM.CO.ZA**

CONSENT

I.....(full names of participant)
hereby confirm that I understand the contents of this document and the nature of
the research project, and I consent to participating in the research project.

I understand that I am at liberty to withdraw from the project at any time, should I
so desire.

SIGNATURE OF PARTICIPANT

DATE

.....

This page is to be retained by researcher

Appendix C- Supplier Questionnaire for Quantitative Data

Question No	QUESTIONS	RESPONSE
	PLEASE MARK YOUR ANSWERS WITH 'X' IN RESPONSE COLUMN	
A	Administrative	
A1	What is the nature of your business operation ?	
	a) product manufacturer	
	b) engineering consulting company	
	c) electrical contracting and construction company	
	d) electrical hardware distributor	
	e) Other (please state)	
A2	Is your company accredited in accordance with ISO 9000 standards ?	
	Yes	
	No	
A2	For what length of time has your company been providing products and/or services to Eskom ?	
	a) 0 to 5 years	
	b) 6 to 10 years	
	c) Over 10 years	
B	Objective : To determine understanding of Total Quality Management	
B1	It's important for my company to have an officially documented quality management system policy.	
	a) strongly disagree	
	b) disagree	
	c) neutral	
	d) agree	
	e) strongly agree	
B2	All my company's staff are knowledgeable about the quality management objectives set for products and/or services we provide.	
	a) strongly disagree	
	b) disagree	
	c) neutral	
	d) agree	
	e) strongly agree	
B3	In our company we have fully optimised the cost of providing quality effort with costs of internal / external failure.	

	a) strongly disagree	
	b) disagree	
	c) neutral	
	d) agree	
	e) strongly agree	
B4	Implementation of a Total Quality Management (TQM) system improves productivity and efficiency within my company.	
	a) strongly disagree	
	b) disagree	
	c) neutral	
	d) agree	
	e) strongly agree	
B5	My company experiences occasional problems with quality management of products and/or services we provide.	
	a) strongly disagree	
	b) disagree	
	c) neutral	
	d) agree	
	e) strongly agree	
C	Objective : To determine your company's commitment to quality management for products and services	
C1	My company's Top Management is practically and visibly committed to meeting Eskom's technical quality requirements.	
	a) strongly disagree	
	b) disagree	
	c) neutral	
	d) agree	
	e) strongly agree	
C2	My company has comprehensively implemented effective continual improvement strategies for products and services supplied to Eskom.	
	a) strongly disagree	
	b) disagree	
	c) neutral	
	d) agree	
	e) strongly agree	
C3	My company has clearly defined quality management policies relevant to all products and/or services provided to Eskom.	

	a) strongly disagree	
	b) disagree	
	c) neutral	
	d) agree	
	e) strongly agree	
C4	Our staff are skilled, trained, competent and capable of meeting specified quality requirements.	
	a) strongly disagree	
	b) disagree	
	c) neutral	
	d) agree	
	e) strongly agree	
C5	Our company consistently reviews whether our products and/or services are achieving quality objectives.	
	a) strongly disagree	
	b) disagree	
	c) neutral	
	d) agree	
	e) strongly agree	
D	Objective : To determine your company's customer focus and commitment to customer satisfaction	
D1	Our company attains customer satisfaction because it's the main aim of our business.	
	a) strongly disagree	
	b) disagree	
	c) neutral	
	d) agree	
	e) strongly agree	
D2	Our company always communicates effectively with Eskom about the quality of products or services supplied.	
	a) strongly disagree	
	b) disagree	
	c) neutral	
	d) agree	
	e) strongly agree	
D3	Our company has an effective system in place to confirm Eskom's requirements where Eskom provides no documented statement of requirements.	
	a) strongly disagree	
	b) disagree	

	c) neutral	
	d) agree	
	e) strongly agree	
D4	Our company always obtains feedback from Eskom regarding our product and/or service quality.	
	a) strongly disagree	
	b) disagree	
	c) neutral	
	d) agree	
	e) strongly agree	
D5	Our company is always able to determine whether Eskom's requirements are met as specified.	
	a) strongly disagree	
	b) disagree	
	c) neutral	
	d) agree	
	e) strongly agree	
E	Objective : To determine the effectiveness of quality controls for products and/or services supplied to Eskom	
E1	Our company's quality control measures don't require any improvement.	
	a) strongly disagree	
	b) disagree	
	c) neutral	
	d) agree	
	e) strongly agree	
E2	Our quality control system ensures defects/defective products are never installed on Eskom networks.	
	a) strongly disagree	
	b) disagree	
	c) neutral	
	d) agree	
	e) strongly agree	
E3	Our products and/or services supplied to Eskom conform to ALL Eskom's standards and specifications.	
	a) strongly disagree	
	b) disagree	
	c) neutral	
	d) agree	
	e) strongly agree	

E4	Eskom is satisfied with the consistency and timeousness of our rectifying non-conformances (NC's) related to our products / services.	
	a) strongly disagree	
	b) disagree	
	c) neutral	
	d) agree	
	e) strongly agree	
E5	Our company's NC controls ensures defects related to our products and/or services are never repeated on Eskom networks.	
	a) strongly disagree	
	b) disagree	
	c) neutral	
	d) agree	
	e) strongly agree	
F	Objective : To determine the impact of product and/or service quality management on Eskom's operations	
F1	Eskom's network performance has improved due to my company's quality management of products and/or services.	
	a) strongly disagree	
	b) disagree	
	c) neutral	
	d) agree	
	e) strongly agree	
F2	Maintainability of Eskom's networks has been enhanced due to my company's quality management of products and/or services supplied to Eskom.	
	a) strongly disagree	
	b) disagree	
	c) neutral	
	d) agree	
	e) strongly agree	
F3	My company's quality management system of products and/or services has helped Eskom reduce its network operating costs.	
	a) strongly disagree	
	b) disagree	
	c) neutral	
	d) agree	
	e) strongly agree	

F4	Quality management of products and/or services supplied to Eskom helped improve its network reliability.	
	a) strongly disagree	
	b) disagree	
	c) neutral	
	d) agree	
	e) strongly agree	
F5	Quality management of products and/or services supplied to Eskom helps it to operate its networks safely.	
	a) strongly disagree	
	b) disagree	
	c) neutral	
	d) agree	
	e) strongly agree	

Appendix D- Structured Interview Questions for Eskom's Employees

Question No	QUESTIONS	RESPONSE
	PLEASE MARK YOUR ANSWERS WITH 'X' IN RESPONSE COLUMN	
A	ADMINISTRATIVE	
A1	What is your job designation in Eskom ?	
	a) Senior Supervisor	
	b) Works Co-ordinator	
	c) Field Services Engineer	
	d) Field Services Centre Manager	
	e) Other (please state)	
A2	What is your length of service in Eskom's employment ?	
	a) 0 to 5 years	
	b) 6 to 10 years	
	c) Over 10 years	
B	UNDERSTANDING OF QUALITY	
B1	What is your view of Total Quality Management as applicable to products and services provided by suppliers, contractors and consultants to Eskom ?	
	a) total quality management is unimportant for services to Eskom	
	b) total quality management does not impact Eskom's operations	
	c) total quality management is very important to services received by Eskom	
	d) total quality management is critical for sustainability of Eskom's operations in the future	
	e) I agree with (a) and (b) above	
	f) I agree with (c) and (d) above	
C	SUPPLIER AND CONTRACTOR COMMITMENT TO QUALITY MANAGEMENT	
C1	What is your view of suppliers / contractors Top Management's practical commitment to meeting your operational requirements ?	
	a) no involvement	
	b) slight involvement	
	c) medium level involvement	

	d) full involvement	
C2	Do you think that suppliers and contractors implement continual improvement strategies in their companies ?	
	a) no evidence of continual improvement	
	b) some evidence of continual improvement is observed	
	c) satisfactory evidence of continual improvement	
	d) all suppliers/contractors display continual improvement	
C3	What is the importance of Eskom's suppliers and contractors having clearly defined quality management policies relevant to products and services provided to Eskom ?	
	a) Not important	
	b) helps with building high quality power networks	
	c) improves performance of power networks	
	d) does not have any effect on network performance	
C4	What are your views on the level of skill, education, training and capability of Eskom's product suppliers and contractors ?	
	a) highly competent and skilled	
	b) acceptable level of skill but need ongoing training	
	c) low level of competence and needs improvement	
	d) poorly trained, lack skills and requires re-education	
D	SUPPLIER AND CONTRACTOR FOCUS ON CUSTOMER SATISFACTION	
D1	Are Eskom suppliers / contractors involved in ensuring your network operational requirements are adequately satisfied on newly constructed networks ?	
	a) not involved	
	b) involved only when called upon	
	c) partial involvement	
	d) full and proactive involvement	
D2	In your view, what is the level of communication from suppliers / contractors about the quality of products or services supplied to Eskom ?	
	a) excellent level of communication	
	b) satisfactory level of communication	
	c) unsatisfactory and could be better	
	d) little or no communication	
D3	What is your view of the adequacy of final quality inspections of supplier products and contractor services prior to handover to Eskom ?	
	a) complete and thorough inspections	

	b) inspections are done but not thorough	
	c) inspections are inadequate	
	d) no inspections are done	
D4	What methods do suppliers and contractors use to monitor whether or not, Eskom's requirements are fulfilled ?	
	a) no methods are used by any of the suppliers	
	b) various methods used by suppliers/contractors	
	c) pre-delivery or pre-handover inspections are done	
	d) checksheets are used for all products and services	
	e) methods are only partially used	
E	EFFECTIVENESS OF SUPPLIER AND CONTRACTOR QUALITY CONTROL AND DELIVERY	
E1	What is your view on the adequacy and frequency of the quality control measures applied by Eskom's suppliers and contractors on power networks in your area of operation ?	
	a) quality control is non-existent	
	b) quality control is randomly applied	
	c) quality control is applied but insufficient	
	d) quality control is adequate for Eskom's needs	
E2	What is your view on effectiveness of the quality control measures applied by Eskom's suppliers and contractors on power networks in your area of operation ?	
	a) quality control is effective in all cases	
	b) effectiveness of quality control is sporadic	
	c) quality control is ineffective	
	d) quality control could be better executed	
E3	Do you think suppliers / contractors consistently ensure conformance to Eskom's network requirements ?	
	a) Eskom's requirements are never met	
	b) Eskom's requirements are rarely met	
	c) Eskom's requirements are often met	
	d) Eskom's requirements are always met	
E4	How do suppliers and contractors ensure that non-conformances (NC's) are identified and rectified ?	
	a) suppliers/contractors have systems to identify and correct NC's	
	b) suppliers/contractors inconsistently identify and correct NC's	
	c) suppliers/contractors only respond to NC's when	

	identified by Eskom	
	d) suppliers/contractors rarely action NC's	
	e) suppliers/contractors do not action NC's	
E5	What is your view on supplier/contractor repeat non-conformance (NC) prevention controls ?	
	a) there are no repeat NC prevention controls	
	b) controls are insufficient and NC's are often repeated	
	c) there are good controls and NC's are rarely repeated	
	d) there are tight controls and NC's are never repeated	
F	SUPPLIER QUALITY MANAGEMENT AND POWER NETWORK PERFORMANCE	
F1	In your area of operation, what effect has supplier and contractor quality management had on your network performance indices ?	
	a) no impact on network performance indices	
	b) negative impact on network performance indices	
	c) slight improvement on network performance indices	
	d) significant improvement on network performance indices	
F2	What effect has supplier and contractor quality management had on your ability to efficiently and optimally maintain your networks ?	
	a) no effect on maintenance activities	
	b) maintenance frequency is increased	
	c) maintenance has become easier	
	d) more defects have been noted on the networks	
	e) less maintenance is required after networks are constructed	
F3	What impact has supplier and contractor quality management had on costs of maintaining networks ?	
	a) no effect on maintenance costs	
	b) maintenance costs have increased	
	c) maintenance costs have reduced	
F4	What is the effect of supplier and contractor quality management on reliability of power networks ?	
	a) no effect on reliability of networks	
	b) generally network reliability has become slightly worse	
	c) generally network reliability has significantly worsened	
	d) generally network reliability has become slightly better in most cases	
	e) network reliability has become significantly better	

F5	How has supplier and contractor quality management helped to improve (or otherwise) restoration times for networks under your control ?	
	a) no effect on restoration times of networks	
	b) generally network restoration times have become slightly worse	
	c) generally network restoration times have significantly worsened	
	d) generally network reliability has become slightly better in most cases	
	e) generally network reliability has become significantly better	
F6	What practical quality management steps do you think suppliers and contractors can implement to improve the performance of power networks under your control ?	
	a) focus on training, education, skills and competency development	
	b) focus on compliance to Eskom's requirements and specifications	
	c) focus on improved quality control	
	d) focus on increasing the frequency of quality inspections	
	e) focus on reducing number of defects	
	f) focus on improving quality of workmanship	
	g) focus on enhancing communication with end-users	
	h) focus on improving equipment resources used on Eskom networks	
	i) any other steps (please state)	